THE MARINE REVIEW

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SHIP BUILDING ON THE LAKES.

The program of ship construction on the great lakes for 1907 delivery includes thirty-two vessels, of which thirty are bulk freighters, one passenger steamer and one car ferry. Twenty-one of these vessels will be built at the various yards of the American Ship Building Co., of which nineteen are bulk freighters, the other two being the passenger boat and car ferry mentioned; seven will be built at the yards of the Great Lakes Engineering Works, Detroit; three at the yard of the Toledo Ship Building Co., Toledo, and one at the yard of the Collingwood Ship Building Co., Collingwood, Ont. The thirty bulk freighters range from 5,500 to 12,000 tons carrying capacity, one of them being 5,500 tons, three of them 6,500 tons, six of them 7,000 tons, three of them 9,000 tons, nine of them 10,000 tons, one 11,000 tons and seven of them 12,000 tons. The total carrying capacity on a single trip is 280,000 gross tons, or conservatively 5,600,000 tons in an average season. Nor is this all. Other contracts for vessels are pending.

On the face of it it would appear as though this prodigality of orders was overstepping the mark. But the cold facts are that last year's program of ship building was nearly as great, the bulk of which is now in commission and has proved inadequate to meet the rapid expanse of lake commerce. Probably in no other single way is the great prosperity that the country is now enjoying better reflected than by this table. This enormous equipment is called into being to meet the country's demand for iron. The program in itself provides work not only for the tens of thousands in the ship

VESSELS UNDER CONSTRUCTION IN GREAT LAKES SHIP YARDS FOR 1907 DELIVERY.

AMERICAN SHIP BUILDING CO.'S YARDS.

To be built at	Type	Dimensions in ft.				No. of Hatches	Spaced Centers, ft.	Dimensions of Engines	Boilers, dimensions in feet and inches	Draft	Steam Pressure, Pounds	Capacity, Gross Tons	For whom building
		Over all	Keel	Beam	Depth								
Bay City	Freighter.	440	420	52	18	23	12	22, 35, 58-42	13.2x12	Ellis & Eaves	170	6,500	Dennis Sullivan, Chicago.
Cleveland	Car Ferry.	270	259	52	19	....	....	14, 22½, 38-32	12 10½x13	Natural	175	.....	Ann Arbor Railway.
Wyandotte	Freighter.	440	420	52	18	23	12	22, 35, 58-42	13.2x12	Ellis & Eaves	170	6,500	Dennis Sullivan, Chicago.
Lorain	Freighter.	605	585	60	32	36	12	22¼, 37½, 65-42	15.4½x11.6	Ellis & Eaves	200	12,000	Weston Transit Co., North Tonawanda, N. Y.
Lorain	Freighter.	605	585	60	32	36	12	22¼, 37½, 65-42	15.4½x.11.6	Ellis & Eaves	200	12,000	Weston Transit Co., North Tonawanda. N. Y.
Chicago	Freighter.	605	585	60	32	36	12	22¼, 37½, 65-42	15.4½.x11.6	Ellis & Eaves	200	12,000	Weston Transit Co., North Tonawanda, N. Y.
Lorain	Freighter.	552	532	56	31	32	12	23½, 38, 63-42	14.6x11.6	Ellis & Eaves	180	10,000	C. L. Hutchinson, Cleveland.
Lorain	Freighter.	552	532	56	31	32	12	23½, 38, 63-42	15x11.6	Ellis & Eaves	180	10,000	John Mitchell, Cleveland.
Cleveland	Freighter.	552	532	56	31	32	12	23½, 38, 63-42	14.6x11.6	Ellis & Eaves	180	10,000	Henry Steinbrenner, Cleveland.
Lorain	Freighter.	440	420	52	28	23	12	22, 35, 58-42	13.9x11.6	Ellis & Eaves	170	6,500	Joseph Sellwood, Duluth.
Bay City	Freighter.	540	520	54	31	16	24	22½, 36, 60-42	13.9x11.6	Ellis & Eaves	180	10,000	J. C. Gilchrist, Cleveland.
Bay City	Freighter.	540	520	54	31	16	24	22½, 36, 60-42	13.9x11.6	Ellis & Eaves	180	10,000	J. C. Gilchrist, Cleveland.
West Superior	Freighter.	552	532	56	31	32	12	23½, 38, 63-42	14.6x11.6	Ellis & Eaves	180	10,000	W. A. & A. H. Hawgood, Cleveland.
Detroit	Freighter.	524	504	54	30	30	12	22½, 36, 60-42	13.9x11.6	Ellis & Eaves	180	9,000	E. D. Carter, Erie, Pa.
Detroit	Pass. St'r.	402	390	54	22	....	....	54, 82, 82-96	13.9x12	Howden	160	.....	Detroit & Clev. Steam Nav. Co, Detroit.
Bay City	Freighter.	600	580	58	32	36	12	24, 39, 65-42	16x11.6	Ellis & Eaves	70	12,000	Pittsburg Steamship Co., Cleveland
South Chicago	Freighter.	600	580	58	32	36	12	24, 39, 65-42	16x11.6	Ellis & Eaves	70	12,000	Pittsburg Steamship Co, Cleveland.
West Superior	Freighter.	600	580	58	32	36	12	24, 39, 65-42	16x11.6	Ellis & Eaves	70	12,000	Pittsburg Steamship Co., Cleveland.
Detroit	Freighter.	524	504	54	30	30	12	22½, 36, 60-42	13.9x11.6	Ellis & Eaves	180	9,000	C. O. Jenkins, Cleveland.
Cleveland	Freighter.	552	532	58	31	32	12	23, 38, 63-42	14.6x11 6	Ellis & Eaves	180	10,000	Pickands, Mather & Co., Cleveland.
West Superior	Freighter.	552	532	56	30	32	12	18½, 28½, 43½, 66-42.	Babcock & Wilcox	Ellis & Eaves	250	10,000	Acme Steamship Co., Duluth.

GREAT LAKES ENGINEERING WORKS, DETROIT, MICH.

St. Clair	Freighter.	440	420	52	28	12	24	21-34½-57x42	13'x12'	Induced	175	7,000	C. W. Elphicke, Chicago.
St. Clair	Freighter.	440	420	52	28	12	24	21-34½-57x42	13'x12'	Induced	175	7,000	Pennsylvania Companies.
Ecorse	Freighter.	440	420	52	28	12	24	20-33½-55x42	12'9"x12'	Forced	175	7,000	Dearborn Transit Co., Dearborn, Mich.
Ecorse	Freighter.	600	580	58	32	36	12	24-37-65x42	16'x12'	Induced	170	12,000	The Pittsburg Steamship Co. Cleveland.
Ecorse	Freighter.	574	554	58	32	33	12	24-37-65x42	16'x12'	Forced	170	11.000	William P. Snyder, Pittsburg, Pa.
Ecorse	Freighter.	552	532	58	31	32	12	24-37-65x42	16'x12'	Induced	170	10,000	Pickands Mather & Co., Cleveland.
Ecorse	Freighter.	524	504	54	30	30	12	23-37-63x42	15'x12'	Forced	175	9.000	Jas. E Davidson & H. L. Shaw, Bay City.

TOLEDO SHIP BUILDING CO., TOLEDO, O.

Toledo	Freighter.	458	438	52	28	13	24	16½, 24, 35, 50-42.	12.6'x12'	Ellis & Eaves	210	7,000	G. A. Tomlinson, Duluth.
Toledo	Freighter.	460	440	53	29	13	24	16½, 24, 35, 50-42.	12.6'x12'	Ellis & Eaves	210	7,000	Smith & Wilkinson, Syracuse, N. Y.
Toledo	Freighter.	460	440	53	29	13	24	16½, 24, 35, 50-42.	12.6'x12'	Ellis & Eaves	210	7,000	Smith & Wilkinson, Syracuse, N. Y.

COLLINGWOOD SHIP BUILDING CO., COLLINGWOOD.

Collingwood	Freighter.	400	380	50	28	11	24	21, 33, 57-42	14x12	Natural	180	5,500	Farrar Transportation Co., Collingwood

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yards of the lakes, but also for the tens of thousands in the diversified workshops of the country, for there is scarcely an industry that is exempt from contribution to the building of a ship. But this, magnificent as it is, is the least impressive part of the spectacle. The real spectacle is the millions upon millions of tons of ore that these ships are to carry to be worked up into all the forms that material prosperity assumes, giving employment to countless artisans in all parts of the nation, but, beyond all, providing a solid base upon which the many-sided edifice of American prosperity is reared.

IMPROVING NIAGARA RIVER.

When Buffalo marine interests secure all the improvements which are provided for in the plans calling for a total expenditure of $4,500,000 by the federal government, including a ship canal in Niagara river, the harbor at Buffalo will occupy a far more important position among lake ports than it does today. The assurance that these improvements would soon be made has stimulated marine and steel interests alike and has given affairs at Buffalo generally a better complexion.

It is expected that within the next few weeks the Empire Engineering Corporation of New York, which was awarded the contract for the next installment of work, will begin operations. Lindon W. Bates will be the engineer in charge of the work. The contract calls for the deepening and widening of the eastern shore of the Niagara river from the foot of Maryland street to a point near the Niagara Range lights. The distance is 6,400 ft. and the cost about $700,000, the amount of the last appropriation.

The improvement will practically abolish the Black Rock canal, the link connecting the western terminus of the Erie canal at Tonawanda with Lake Erie. A wall of stone masonry divides the river and the canal but in several places there is no wall and the river and canal merge. The ship canal will follow the course of the Black Rock canal but as the width called for is 200 ft., the Niagara river will be the scene of most of the dredging. The channel is to be 23 ft. deep. Between Squaw island and the mainland at Tonawanda the waterway will be 400 ft. wide. Here the canal opens into the river and at this point considerable work is to be done. There are few places along the route of the proposed ship canal where the water is more than 8 ft. deep, and the water in the Black Rock canal is only 9 ft.

The contract which the government has made with the contractors does not call for the completion of the work before Dec. 31, 1908. It was expected that the work would have been started before this but from excellent authority it is learned that the delay in commencing the work is due to an experiment the corporation is working out. It is the plan of the company to introduce a new system of dredging. They desire to deviate from the old method of perpendicular drilling and dynamiting and use a horizontal machine. The claim is set up that this machine will do the work more rapidly and that the time lost now in conducting the experiment will be more than made up when the machinery now under construction is put into use. The chief point of difference between the old and new idea, it is said, is the conversion of the perpendicular drill into one which works in a line parallel with the surface of the water.

Buffalo marine men are hoping that the next appropriation will provide for the completion of the ship canal from the Niagara Range lights to Tonawanda. This will be a great work. It will include the construction of a large lock, big enough to hold vessels of the largest type in the ore trade. This will replace the small lock below the International bridge and between Squaw island and Tonawanda. The new lock will have a drop of five feet. While the lock now in use there has a similar drop its capacity is only for small craft.

Dredges are now employed in finishing the old contract given for the widening and deepening of the river from the main entrance of Lake Erie to the Philadelphia & Reading docks at the foot of Maryland street. It is hardly likely that this work will be finished this season. If so, it will be late this year.

Men who have made a study of the conditions which are likely to shape Buffalo's future are most optimistic in their predictions. They believe that the ship canal should be a reality in a few years—perhaps four years. Then, they say, will rise up from the banks of the Niagara river great steel mills and various other industries engaged in the production of iron and steel products. It is now no secret that well known capitalists, familiar with the iron and steel industries, have, through their representatives in Buffalo, secured options on several important pieces of property between Buffalo and Tonawanda. The importance of this improvement upon the steel making industry of Buffalo cannot be overestimated.

The officers of the Moran Co., Seattle, Wash., are George H. Higbee, president; J. V. Paterson, vice president and general manager; James Gibson, secretary and treasurer.

MARINE HULL INSURANCE.

Buffalo, Aug. 8.—There seems to be considerable change ahead in marine hull insurance. Some of it has taken place within a short time and some is merely suggested as yet. It seems to be confessed that the control of the business is still held in London, though it was stated some time ago that there was home capital enough to cover all risks, large as most of them are compared with what they were a few years ago. Quite likely this holding of the balance by an interest that is so large and varied that the balance wheel rolls around only at a slow rate is best. American capital is too exacting and capricious for some of the endless-chain enterprises which do not show anything but long-interval results, figured out long after the facts have accumulated.

The London Lloyds cover the insurance world and in so many divisions that earnings are not summed up at the end of a season as the lake underwriting used to be, and that interest is now getting to be so much slower to show results that it is no longer possible for the head of the big lake hull office to bundle up his tally sheets before a new session of navigation opens and show them to the companies engaged in marine underwriting as proof that there is money in the business. Some one is noting that the barge Algeria, which went down, I think in May, held hull policies that were just about to expire from the year before. It is added that she could not have obtained anything like the amount of insurance again that she carried then, for this was her eleventh season, and besides the rate would have been quite a little higher.

It is predicted, as one of the changes likely to take place soon, and quite likely next season, that the underwriters will throw out all the wooden vessels. This opinion was given out the other day by a leading lake underwriter and it is not at all out of line with the general tendencies of the business. Shippers complain that they now have to contribute to the hull insurance of such craft and they do not like the idea. It is very odd to the lay mind that the days are not so very far past when insurance could be had regularly on class B barges and money was made in the business as it does not seem to be now, with all the big demands on government for better lights and better water met and fairly forgotten.

It was only a week or so ago that the final form of hull policy was decided upon. The action of the English authorities early in the present season put an end to the deductible

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average soon after the lake season opened and after that certain other influences conspired to bring about a modification of the policy till at last one has been issued that is about as liberal as it could well be. The collision clause is again extended to "rafts, wrecks and docks or with any substance or thing other than water." Small losses are, of course, covered now since the deductible average is off.

The new policy is now in force to Dec. 12 and one-fourth per cent net for extension. This, of course, contemplates steel bottoms and it may easily be held that everything else can easily be left out of the reckoning, for it will soon be gone anyhow. Just what will be done with the wooden fleet and how the ports that are confined to such vessels are to get along remains to be seen, though the owners of the lumber fleet are getting pretty well used to carrying their own insurance.

On account of the delay in coming to an agreement over the exact form of policy the clerical work in the hull offices has been very slow, many of the policies not being issued yet, though all haste will now be made to get them into the hands of vessel owners, as there is no further reason for waiting.

As to earnings and prospects the report is now very confident. There have not only been some big losses, but the offices note that many smaller ones and some of them not so very small either are known to them which have not been reported in the newspapers. The underwriters are hopeful, though they are aware that there is no heavy margin to their credit to meet any such fall as that of last year. It is not likely that a second series of such disasters as were spread over three months of last fall will recur this fall, if indeed it ever does.

There is all of the former uneasiness among the underwriters over the failure of the big fleets to insure, for this is bound to increase as the ownership becomes concentrated, though the increase of actual tonnage is a counter influence. Some of the uninsured fleets have been hit very hard lately and there are predictions that they may return to the insured fold again next season.

JOHN W. CHAMBERLIN.

Of the many boats putting in at Ashtabula, the steamer Francis L. Robbins has perhaps the most distinctive appearance with her hull painted green and the big "B" on her stack. The "B" lets the landlubbers know she is owned by Mr. W. H. Becker.

QUESTIONS FOR OILERS AND WATERTENDERS.—NO. 1.

The MARINE REVIEW herewith begins a competition question course for oilers and watertenders similar to the courses now running in its columns for wheelsmen and watchmen and masters and mates. The purpose of the course is to prepare oilers and watertenders for examination. The questions will all be practical, such as the inspectors of the steamboat inspection service would naturally ask. Any oiler or watertender who enters into the course cannot fail to be benefited thereby. The course is projected to help them and the real benefit is the instruction which they will receive. As an incentive, however, four prizes will, as in the other contests, be offered. The oiler or watertender, having the highest average, will receive $50 in gold, the second highest $25, the third highest $15 and the fourth $10. Oilers and watertenders generally are invited to mail their answers to this office. The percentage of correct answers will be noted upon the letters and at the conclusion of the contest prizes will be awarded. Following is the first list of questions:

1. What would you consider your first duty on entering an engine room?
2. What would you consider the most essential duty in the care of the dynamo?
3. State three qualifications required by an oiler.
4. State three qualifications required by a watertender.
5. If you heard a pounding in the air pump what would you consider the cause?
6. State a safe remedy.
7. Why does one boiler of a battery require more feed water than another at times?
8. What effect would the opening of the soot-box door have on a tubular boiler, fires being in the same shape as the other boilers.
9. In case the water in the boiler should fall so low you could not ascertain its height by simply glancing at the water glass, what could you do to tell whether it had fallen below the safety limit or not?
10. Why is the L. P. cylinder of a compound engine larger than the horsepower.

QUESTIONS FOR MASTERS AND MATES.—NO. 4.

In the list of questions given for masters and mates in the MARINE REVIEW, July 19, an error was made in printing question 16. The word "variation" in the last line of this question should have read "deviation." The question is therefore repeated correctly as follows:

Ques. 16. The true bearing through the Sturgeon Bay ship canal is NW ⅛ W, the variation is 2¼ degrees easterly; how should you head going through the canal if your compass was right, that is, free from deviation; supposing that when you went through the canal your compass read NW ¼ N, how much is the deviation and which way is it?

Hereafter the questions in the masters' and mates' course will be numbered chronologically, so far fifty-four questions have been asked. Following is the fourth list:

55. What is a relative bearing? Explain its use.
56. Which way do you allow easterly variation in converting a correct magnetic course to a true course?
57. The true course is N 38° E, the variation is 5½° westerly and the deviation 11° easterly, what is the compass course?
58. What is the difference between a compass bearing and a correct magnetic bearing?
59. In which direction has the compass card turned with easterly deviation?
60. State a rule for naming the deviation after finding its amount by the difference between the compass bearing and the correct magnetic bearing?
61. If you were to trace on a magnetic chart the line of variation having beside it, say 5° W, at what angle would you be from the true meridian all along this line?
62. What is the magnetic meridian of any place? How would you determine it?
63. You are steering NE by compass when an object on shore bore E by S by the same compass, what is its relative bearing?
64. A compass having natural deviations, that is, a compass that is not adjusted, has one point of easterly deviation with her head correct magnetic north. What would be the reading of this compass with the boat heading correct magnetic north? On south correct magnetic the deviation is of the same amount; but which way will this deviation be and what course by compass would you have to steer in order to make good the course of correct magnetic south?
65. If you took the bearing of a lighthouse by compass and you desired to lay it off from the same lighthouse on the chart, what conversion would you have to make to this compass bearing before it would agree with the chart; and which way would you al-

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low the variation and deviation, if you had any?

66. What is the latitude and longitude of Poe's reef lightship as shown on the chart?

67. Two boats start from the same point, one steers N by E 100 statute miles, and the other N by E 100 nautical miles. At the end of each course how far will each boat be (in its own miles) from the meridian on which they started?

68. What should a log indicating nautical miles indicate on the course between Chicago and Pt. Betsey?

69. Why is it that a compass bearing of an object will not agree when you lay this same bearing on the chart from the same object?

QUESTIONS FOR WHEELSMEN AND WATCHMEN.—NO. 5.

Give all shoals and principal landmarks passed on either hand.

In taking courses to make good the correct magnetic course you should apply to the true course the mean variation from point of departure to destination.

52. Give correct magnetic course and distance from two miles NW Cleveland breakwater light to Bar Pt. via north passage.

53. Give correct magnetic course and distance from two miles NW Cleveland breakwater light to Bar Pt. via middle passage.

54. Give correct magnetic course and distance from Toledo straight channel light to Bar Pt.

55. When leaving Buffalo what marks have you to guide you that you can clear Waverly shoal?

56. When going to Buffalo what marks have you to steer on?

57. What marks have you to know when to haul for north breakwater entrance?

58. How do you enter Erie harbor?

59. How is the Erie harbor channel marked inside?

60. What is the true range of Conneaut harbor?

61. What is the correct magnetic range of Ashtabula harbor?

Very late advices from Hakodate, Japan, state that the British ship Dumbarton will have to undergo extensive repairs aggregating nearly $40,000. About a year ago the Dumbarton was reported to have been wrecked on the Siberian coast north of Sakhalin, with a general cargo, under charter to the Barneson-Hibbard Co., of San Francisco. The vessel which was on a reef for months was finally floated and taken to Japan.

SALVING THE MARIECHEN.

The big tramp steamer Mariechen, lying at dock at Esquimalt, is a fine example of what can be accomplished with a well-equipped salvage plant. When this vessel, bound from Puget Sound to Vladifstok with 4,500 tons of cargo stored in her capacious holds, went ashore at False bay, Alaska, after drifting helplessly about on the Pacific for thirty days last December, there were few who believed that she would ever be floated and brought to dock. Among the few who did believe such a thing possible were Frank G. Taylor, Puget Sound representative of the German underwriters, and Capt. S. B. Gibbs, agent and chief surveyor of the Marine Board of Underwriters, who represented Mr. Taylor in this work. As soon as it became known that the Mariechen went ashore Capt. Gibbs went to Juneau, and from there to the scene of the wreck. The British Columbia Salvage Co., Ltd., of which the Bullens are the head, were notified of the wreck, and the wrecking steamer Salvor, with Mr. Harry Bullen aboard, started for the wreck.

THE MARIECHEN IN DRY DOCK.

The Salvor had twenty-eight men aboard, including divers, machinists, steam fitters, etc., and after a short stop at Juneau to pick up Capt. Gibbs, made for the wreck, arriving at False bay, Feb. 24. The weather was good at this time, and three days were spent in examining the bottom, to determine the extent of the damages. Three divers were employed. They reported that the ship was lying on a gravel bed. There was an overhang of 20 ft. from the stern post forward, and for 180 ft. she rested on the sand; then for 100 ft. she rested on a jagged reef of rocks, and for the balance was an 80-ft. overhang. An examination was also made of the holds, and it was found that in No. 5 there was flour and salt; in No. 4 salt, flour and beer; No. 2 canned goods and soap and in No. 1 coal oil, barrel beef, leather, carriages, hardware, etc., making 4,500 tons in all. Another thing done was to cut a piece of the hull to determine the character of material. It was found that she was a magnificently built vessel. After this examination the Salvor returned to Juneau, and a bid for the raising was submitted to Capt. Gibbs, who in turn wired same to Seattle and received instructions to go ahead with the work. The Salvor returned to False bay and active work was started on March 3.

Mr. Harry Bullen, in speaking of the work to the editor of *Railway and Marine News*, who visited him at his yards in Victoria last week, said:

"When we started active operations the first thing we did was to place the pumps aboard the Mariechen, which was lying at an angle of about 35 degrees. We used five pumps, one eight-inch and four 10-in. These were distributed as follows: One 10-in. pump in No. 1 hold, two 10-in. pumps in No. 2 hold, one 10-in. pump in the engine room and the eight-inch pump in No. 4 hold. In placing the pump in the engine room we had to put it down through No. 4 hold and then cut a hole through the engine room bulkhead. We fitted the pump with suctions and discharge pipes. We next placed four boilers aboard, two forward and two aft, and connected them

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with the pumps and also with the ship's winches and capstan. Owing to the heavy list we were compelled to use long wedge shaped timbers to give the boilers an even base. This work took 30 days, and while it was being done the cargo was taken out of the holds, and under Capt. Gibbs' directions was shipped to Seattle and sold for the benefit of all concerned.

"In order to make room for the suctions the divers had to remove cargo from the lower holds. The foot valves to all the pumps had to be encased in large crates, bound with galvanized wire, in order to keep the flour and salt sacks from plugging, as the holds were full of water. All the time these preparations were going on cargo was being worked day and night, and under the circumstances it was a nasty job, as the stench was pretty bad.

"When the pumps were all connected the divers were sent down, and it was found that practically all of the damage was under No. 2 hold. The reef of rocks upon which the vessel rested was uneven and jagged, and were pushed up inside the ship at this point. We put clutches on the end of long poles and gave them to the divers, so that they could poke waste and oakum as close to the damage as possible. This was carried on night and day also, and each diver had an electric light strapped to his arm, the wires used being heavily insulated. Imagine the difficulties, under which these divers worked when I tell you that they had to lie flat on their stomachs and pass waste and oakum to the damage. There was a 20-ft. rise and fall of tide and the water kept taking the material away almost as fast as the divers put it in. To obviate this as much as possible a port hole was cut on each side of the ship, and a door made of heavy leather and fastened by ring bolts fitted. When the water was rushing out of the ship as the tide went out much of it went out through these ports, relieving the strain on the injured part. When the tide would rise these doors would be pulled shut. After keeping the divers at this work until they made good headway we shifted to the bulkheads. This necessitated handling all cargo lying close to the bulkheads. This we moved and stored it up to the weather side, making a cribbing for it. We took one bulkhead at a time from the after part of the ship forward. When we got all the bulkheads tight from the forward end of the engine room bulkhead aft, we pumped out the after end, and raised it about nine feet. This helped us to get at the damage under No 2 hold, and gave a lot of information as to where the water was coming from, etc. We decided that we must put out more cargo and get at the damaged parts from the inside.

"Taking the cargo out from the bottom of the hold was a slow and tedious job. The bottom of No. 2 hold was pushed up five feet, and as this is the biggest hold in the ship the flour was squeezed up so tight we could hardly move it. It took some days to remove this, but when we did get it out the divers were sent down and placed cement over the damage. The cracks in the plating in No. 1 hold were filled in with dried spruce wedges. When everything was in readiness we started in pumping at 4 o'clock in the morning and between 8 and 9 that night had her afloat. We made fast to the Salvor and started for Juneau. After reaching that port we shifted cargo from port to starboard. This exposed the port bilge and the margin plates. It was found that the tank tops were badly fractured. The frame for quite a distance was drawn away from the margin plates. The No. 2 bulkhead was also drawn away from the shell plating.

"We cemented the port bilge throughout the entire length of No. 2 hold. A cofferdam of solid cement was built to about four feet over the most badly fractured part. This was shored up the entire three decks. This made her ready for the trip down and in that shape reached the dock at Esquimalt.

"It was a hard job and we took a long chance, but everything came out all right, and I am mighty glad we are home. There were many disagreeable things to contend with, but they are to be expected at such a place and at that time of year. One of our greatest troubles was to get fresh water. When the weather was good we were compelled to row metallic life boats several miles to a creek, fill them and start right back again. When the weather was bad we had to take the Salvor to Funter's bay, 18 miles away to load up with water. When the weather was good things went along smoothly, but when we got a long stretch of southeast gales it was anything but glorious."

Among marine men, who are familiar with the conditions, the salving of the Mariechen was among the best pieces of work ever done on the Pacific coast. The Salvor is fully equipped for the work, and in fact is a self-contained vessel, having aboard everything required for such work. She shows the effects of the trip, but with a little paint and a few minor repairs will be as good as new in a short time.

BATTLESHIP LAUNCHED BY ELECTRICITY.

The launching of the new British battleship Agamemnon which took place on June 23 at Dalmuir, Scotland, was marked by the use of ingenious new mechanism. According to *Engineering* the particular berth upon which the Agamemnon was built was specially prepared for the laying down of a vessel of the largest and heaviest type, great care having been taken in the piling of the area. Nearly 1,000 pitch-pine logs, each 40 ft. long and 12 in. square, were driven vertically into the ground, with cross-ties on their tops, the total quantity of timber used in the preparation of the berth amounting to about 80,000 cubic feet.

The declivity of the keel-blocks was about 7-16 in. per foot, the standing-ways being laid at a declivity of ½ in. per ft. with a camber of 12 in. in their whole length of nearly 700 ft. The distance between the ways was 26 ft. 6 in. center to center, and the breadth of the sliding-ways was 5 ft. 9 in. The sliding-ways extended from about 50 ft. from the stem to about 50 ft. from the stern, the pressure per square foot on the standing-ways being about two tons. In accordance with the most recent practice in His Majesty's ships, the frames in way of the propeller-shafts are not bossed out in the Agamemnon and special arrangements and cross-ties were fitted to take the after poppets under the vessel at the after end of the ways. The poppets at the fore end were specially designed and strengthened to take the great downward pressure which comes into play at that part, when the stern of the vessel, being water-borne, begins to rise. For this purpose four heavy girth-plates, each about 3 feet wide, and formed of two plates each ⅞ in. thick, were carried under the keel and up on each side of the vessel, and connected at their heads to a heavy continuous stringer, likewise formed of two ⅞ in. plates. Strongly attached to the continuous stringers, and at right angles to the hull of the ship, were fitted continuous shelf-plates, with strong vertical brackets at about 2 ft. intervals on their upper sides, riveted to the shelf-plates and the continuous stringers to take the heavy vertical timbers forming the fore poppets. The girthing-plates and stringers were not attached to the shell or framing of the ship, but the spaces between them and the shell were filled in with hard wood to give a fair surface, and the cradle thus formed was held firmly in position by means of wire hawsers attached to eye-plates on the brackets, and carried up

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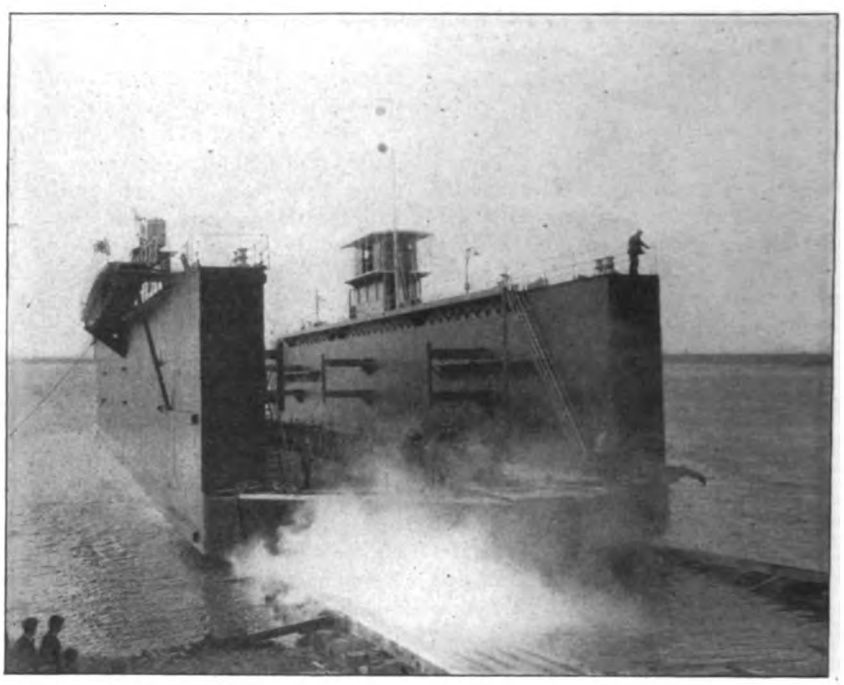
and made fast at the upper deck of the vessel. The advantage of this arrangement is that after the launch these hawsers can be let go, and the whole cradle falls away from the vessel and is lifted clear by the crane while she lies in the builder's fitting-out basin, whereas by the usual method of attaching the cradle to the hull this cannot be removed until the vessel goes into dry dock.

Up to date in every respect, Messrs. Beardmore have replaced the old type of dog-shores by an ingenious electrical arrangement, connected to a series of interlocking levers, which release the triggers that hold the vessel until the signal is given that all is ready for launching. Two separate triggers were placed on each side, each fitted with magnetic reply gear to indicate on the launching platform that the mechanism had worked satisfactorily. The whole gear was controlled by means of a miniature steering-wheel and standard placed on the launching-platform, and so adjusted that when the Countess of Aberdeen, who performed the ceremony, gave the wheel one complete revolution, the triggers were released, and the vessel was free to run down the ways. A powerful hydraulic ram was placed at the forward end of the sliding ways on each side of the vessel, the cylinders being coupled to the same supply-pipe to ensure equality of pressure. These rams were for the purpose of giving the vessel a start if she had not moved directly the triggers were released; but in this instance they were unnecessary. The drags for checking the "way" on the ship after she had successfully taken the water were formed of chain cables; three piles being arranged on each side to come into play at suitable intervals. The total weight of drags employed was about 600 tons, and their action in bringing the ship to rest was in every way satisfactory. The total time taken from the start until the vessel was actually clear of the ways was one minute 51 seconds.

The newly acquired steamships Doric and Coptic are not only to henceforth sail under Pacific Mail Steamship Co.'s colors, but are to be rechristened very soon. The Doric will be renamed the Asia, and the Coptic the Persia. Formal application will be made shortly for a change in the names of these steamships, but owing to the necessary red tape attending the transfer it will probably be some time before the rechristening will take place.

THE HASLAR FLOATING DOCK FOR SUBMARINE BOATS.

There has just been constructed to the designs of Messrs. Clark & Standfield by Messrs. Vickers Sons & Maxim, Ltd., Barrow-in-Furness a special type of floating dock intended for submarine boats, which will, it is expected be an important addition to the resources of the Portsmouth dock yard. This dock, intended primarily for the use of submarines, is capable of picking up any vessel of this class out of the water in half an hour or thereabouts. The length of the dock is 250 ft., the clear beam between the fenders is 32 ft., while the maximum depth of water over the blocks is 16 ft. These dimensions are, of course, much larger than is required by any submarine, but it is also intended, if necessity arises, to utilize the dock for lifting destroyers and other small craft weighing not more than the lifting power of the dock, namely, 100 tons.



FLOATING DOCK FOR SUBMARINE BOATS AT PORTSMOUTH NAVY YARD.

The official trials of the craft have just been made, and the destroyer Gala, which had been reduced to a displacement of 500 tons, was selected as the trial vessel. By means of the dock's own appliances she was centered, and berthed in about 20 minutes, no cutting or wedging up of shores being necessary, and in 28 minutes from the time she touched the blocks the keel of the Gala was out of the water, and in eight minutes more, the whole of the pontoon dock was above the surface. Owing to the supply from the power station not being available, current for working the pumps and capstans was obtained from a submarine moored a short distance away. The dock is of the double-sided type, and all the working arrangements are on one side. The motive power is electricity conducted on board by cables laid on a hinged boom, one end of which is attached to a jetty and the other to the back of the dock. One very noticeable feature is the valve house, which, instead of being placed, as is usual, on the deck of the wall, is on top of the motor house, so that the dock master has an exceedingly good view of all that is going on without being interrupted by anyone going to and fro on the wall deck. On the opposite wall to the valve house is a powerful traveling crane, which can plumb the center of the dock. This is worked by hand power, plenty of which is always available when a vessel is being repaired, when the dock is placed in its final position—that is, near Haslar, on the western side to the entrance to Portsmouth harbor—it will be moored between four dolphins, constructed of ferro-concrete, and will be anchored in position by means of the hinged boom before referred to. The dock is fitted with all the usual labor-saving devices found on structures of this kind, and is admirably adapted for the work it has to do. One illustration which shows the dock being launched has been supplied to us by the builders, Messrs. Vickers Sons & Maxim, naval construction works, Barrow-in-Furness.

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HOLLOW STAY BOLTS.

Editor MARINE REVIEW:—In the report on flexible staybolts, read at the Master Mechanics' convention at Atlantic City, there were a few references to hollow staybolts which merit attention. This report covered a single type of bolt, evidence had been sought on that type alone, and any reference to other types on which evidence had not been obtained was certainly irrevelant, unfair and uncalled for.

This report was not written, and I think not read, by the good men whose names are joined to it, and as any erroneous or malicious statement is against the public interest, permit me in justice to the makers of the hollow staybolts and the railroads of this country, to call attention to some of the statements of the writer of the report, a recent graduate of Cornell, and compare them with the cold facts of actual experience, and the record of actual service.

He says, "As the use of the tell-tale hole is a disputed practice, its action not being accepted as positive, and as it adds to the expense of application and maintenance, it is not to be recommended." I agree with the writer *only* in that statement, and let me say that while waiting for a train at Sunbury, Pa., I went into the shops there and was shown about a dozen bolts which had been taken out of an engine a few days before, they were broken and steam had failed to indicate failure, because the tell-tale holes were filled in part, with dirt, so hard that it felt like metal when I tried the holes. I have seen many other cases like this in different parts of the country, but I have never seen a hollow staybolt which was closed by dirt or sediment.

He speaks of the claims made for hollow staybolt, viz: Better combustion, and absolute indication of failure of the stay, and casts them aside with the remark that these claims are "not proven." Our young friend certainly shows unexpected hardihood, and simply trusts his "not proven" against both prima facie facts in science and the cold stern facts of actual service, not service of a few years, but the service of from ten to twenty-five years, it would seem that his "not proven" will be jolted.

Quite recently the firebox of a switch engine, on the Lake Shore & Michigan Southern Ry. was removed. It was built at Schenectady, in 1892. Mr. Fred Lippert, a fellow student of Cornell with the writer of the report, examined the hollow bolts with which it was stayed, and "found the holes in all the bolts free from sediment, scale or dirt"—14 years' proof that the hollow bolts were absolutely reliable detectives. This engine carried 150 lbs. pressure.

Every student of combustion knows that it is desirable to admit air in well distributed quantities among the gases. When we do this the gas is burned, when we do not do so the gas becomes black smoke and the heat is lost.

Before the hollow staybolts became a *fait accompli*, about eighteen years ago, there had been installations of hollow material for the purpose of bettering combustion. I have seen within a year some of the old engines that received those installations to better combustion, they have been in service since, on—

The Southern railway, engine 1884, built in 1881 with hollow staybolts on each side of the fire box.

The Boston & Maine Ry. Two engines in 1883 and one in 1888 with hollow staybolts on each side of the firebox.

The Pittsburg, Shawmut & Northern Ry. Four engines built in 1890, stayed with Falls hollow staybolt iron and in service since.

The Long Island Ry. Ten engines stayed, over 10 years ago with hollow staybolt iron, in service since, without change until 1905, when a new firebox was installed.

The Texas & Pacific Ry. has been saving money in bettered combustion by air through hollow staybolts for over ten years.

The International & Great Northern Ry. has been saving money in bettered combustion by air through hollow staybolts since 1892.

The Canadian Pacific Ry. and other railways, east, west, north and south, and in foreign countries, have had experiences which refute the "not proven" of the writer of the report.

And now, as all other bolts are solid and he does not approve of the tell-tale hole (nor do I) where, except in the hollow staybolt, can he get a bolt of any description that will "absolutely indicate failure," and what bolt, save the hollow staybolt, can be utilized to better combustion.

The man who tears down a useful article should have something better to take its place, if not he is an enemy to progress.

The writer of that report has found nothing better to take the place of the hollow staybolt. A studious reading of his own report will show that as an alternative deduction, and his evidence otherwise, proves his conclusions inconsistent and erroneous.

I saw in the testing room of one of the large railways in the south, samples of broken solid staybolts, which had been coated with impurities from the water, preventing the conduction of the heat from the bolt to the water. The ends of the bolts when coated had commenced to burn, and the burning had continued along the line of the fibres until the steam pressure between the inner and outer sheets pressed the inner sheet out over the bolt heads. The bolts for about half their length were reduced in diameter, the threads were gone, and the diameter was smallest just inside the inner sheet; a part of the coating had dropped off the other half of the bolt, allowing the water to get to it, and that half of the bolt with its threads was uninjured. Those were dangerous conditions which the writer of that report would promote, and which could not have occurred if the hollow staybolt had been in use, owing to the passage of air through them.

The outlay by railways for weekly or monthly tests with a hammer to discover by sound the broken staybolts is large—and an uncertain costly way by which to discover breakages. Tell-tale holes add more to the cost of examination. The drilling of tell-tale holes in the ends is a disputed good, in my opinion a substantial evil, whereas there is a warning at either end of every hollow staybolt in the firebox to report breakages when breakages occur, without the touch of a hammer or the cost of a cent, and without risk of a law suit, such as related as follows:

"We had an explosion."

"What," I said, "was the cause?"

"Oh, the witnesses swore the examination was imperfect."

"What examination?"

"An examination of the staybolts."

"Was the explosion caused by a broken staybolt?"

"Yes."

"And what was the result of the suit?"

"Oh, there was a verdict against us for $10,000."

"And what was the brand of iron in the staybolt?"

"It was the ——— iron."

"What an awful price, I said, to pay for ——— iron."

In contrast to that experience. I was in conversation, at the convention, with a superintendent of motive power, having 350 to 400 locomotives, a constant user of hollow staybolts for over ten years. He said he had no anxieties about breaking staybolts, for when they break they make the breakage known. No examinations are necessary, for the holes are always open, and exultantly he said he was able to keep 97 per cent of his engines in service. His savings in respect to examinations alone amount to $25.00 to $35.00 a day.

That man had no fear of having $10,000 to pay for damages by reason of explosions. He had no grief to trouble his thoughts about a widow and fatherless children with their bread winner sacrificed to "imperfect examinations." He did not depend on fallible man, he depended on the hole through the center of the bolt.

JOHN LIVINGSTONE.

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DULUTH HARBOR IMPROVEMENT.

Greatest interest in marine circles during the past week has been centered in the investigation by the board of government engineers and the discussion developed by it, anent the improvements proposed for the harbor at Duluth. The discussion narrowed down to arguments for and against two propositions,—the building of a breakwater outside of the present entrance, extending parallel to Minnesota Point, from the foot of Fourteenth avenue east about 6,000 feet out into the lake and about 4,000 feet from the ends of the pier,—and the cutting of a new canal through Minnesota Point, opposite the St. Louis river. The board besides its own investigation, held an open meeting at which all the interests having property affected by the conditions complained of in the harbor, were represented. This contingency, in which the leading spirit was Capt. Alexander McDougall, have committed themselves as being in favor of the breakwater constructed as outlined above and as suggested by Capt. McDougall and against a central canal. The advocacy of the central canal was presented at the last minute of the board's session by W. A. McGonagle, vice president of the Duluth, Missabe & Northern railroad, in the form of a message from Cleveland signed by Harry Coulby and A. B. Wolvin, which read as follows:

"In answer to yours No. 645. If I had known of the board meeting of the government engineers in Duluth I would have arranged to have been present. Captain Wolvin is now in my office and we are absolutely opposed to the building of a breakwater from Fourteenth avenue east, as being a thoroughly impracticable proposition. Furthermore, the object of the rivers and harbors committee is the improving of the waterways for the benefit of commerce. A central canal through Minnesota Point will save fully one hour on each trip of each vessel entering the Duluth harbor bound for the Missabe docks or any other dock in the vicinity of or above Rice's Point or Connor's Point. Apply the saving at this rate on the boats to the Missabe docks alone and you will see the force of this argument. The large modern ships of today must have room to navigate, and after having given this subject much thought and study, we are absolutely of the opinion that the only solution is a large canal entrance through Minnesota Point.

"Would it be possible for the board of engineers to have another meeting later either in Duluth or Detroit or any other place they may designate to give us an opportunity to appear before them?"

In response to the request a hearing was set for August 6 in Detroit.

That the size and importance of the port of Duluth justifies whatever improvement will best remedy the evils existing is undisputed. That three distinct evils do exist is equally admissible. The are,—first, and most important, because of the danger to life and property that it involves, the current back and forth through the canal; second, the damage to dock property in the harbor and the interference with loading and unloading due to the surging of the harbor waters, in times of a northeast wind; third, the present roundabout channel for boats going to all points on the inner bay, to most of the canal docks, and to the Missabe docks. The opposing interests are naturally biased in their respective opinions toward a remedy that will prevent first, the evil that affects them most and secondarily, the evil that concerns the other fellow. It so happens that the vessel interests, at least that part which docks in the river, suffer almost entirely from the first and third evils and the dock interests or the advocates of a breakwater, from the second. On the basis of damage already received and property involved, the vessel interests have beyond question the balance of weight in the matter of argument, for there is scarcely any one single property in the harbor either dock or elevator whose value equals that of one of the big freighters and the disproportion in numbers needs no mention. In the aggregate it would seem in all fairness to the local capital concerned, remembering that the improvement is a government work and intended to serve everyone impartially in proportion to the interests involved, that if all the evils cannot be remedied at once the most far-reaching evil should be attended to first. Even with the advance in real estate which it is anticipated will result from the formation of docking properties inside the new breakwater, the same general principle holds true.

The damage to any of the docks amounts to $10,000 yearly in addition to costly delays and in the storm of last November the piling up of the water in the bay resulted in far greater harm. This action of the water it is claimed results from the unprotected condition of the entrance and the nature of the channel which permits the alternately in and outgoing current. They say these disadvantages have been increased with the new canal which is nearly twice as wide as the old one. To counteract this condition the breakwater is proposed as above, with the statement that it will afford the added advantages of greater harbor space, both for pleasure and refuge, and that it will make the entrance into the piers more safe for it will provide calm water. The experience of the men back of this proposition and their knowledge of the harbor give reason to believe that all that is claimed would be gained by building a breakwater. The argument against the central canal is that the present expensive canal would have to be abandoned, that the inrush of water through a canal opening in from a clean sweep of the lake would be greater than in the present entrance, that a breakwater would be necessary to protect that canal also and that it would be an entrance less easy to make. For it is claimed that in a dark night or a snow storm where no other means offers, for obtaining their bearings, it is

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customary for captains to try and locate the north shore and by means of echoes follow it to Duluth which course would, it is claimed, make the present channel, right in the corner of the lake, easier to find than one-half way between Duluth and Superior. That captains do so locate themselves is also urged because of the small dependency which can be placed on a compass in these waters owing to the magnetic variation.

The dock interests on the Superior side of the river support the breakwater proposition also as against the central canal on the very evident grounds that if there is any wash through the canal and even in Superior damage has resulted, that the farther away the canal the better, and to do the best that can be done with the present canal which is as far away as possible, is better than taking any chances with one close by. This is the situation as it was presented to the board, so consistently and with so little rebuttal from the many dock and elevator owners and captains who gave opinions that common report credits marine Duluth as strongly opposed to a central canal and decidedly in favor of a breakwater.

At the Duluth meeting vessel owners in general were present and remarks were made by Harry Coulby, president and general manager of the Pittsburg Steamship Co., and Harvey D. Goulder, counsel of the Lake Carriers' Association. Mr. Coulby stated that he was speaking rather for his captains than for his company. He thought the men on ship should have protection. His talk was based upon what they had told him of the difficulties of maneuvering at that port. He argued that the big boats must have room to move about in, and that a middle canal through Minnesota Point was needed. He favored a canal from 750 to 800 ft. wide and was opposed to the proposed breakwater. He added that the feelings of owners of dock property should not be consulted and that if damage resulted to shore property the government should reimburse the losers. He also emphasized the time that would be saved in making port. Mr. Goulder argued along the same lines and stated that fully 80 per cent of the vessel owners were in favor of the canal.

That the proposed canal will save an hour's time in running for the entrance and in winding around to reach the river is apparent which means, figuring that 3,000 boats come to port for these companies during a season, a saving during the season of the earnings of one of the largest freighters for the season. It may also be pointed out that with a canal of the width proposed and in the central location, no harbor on the lakes will have a safer entry. Furthermore it seems as though the dock interests at the Duluth end of the bay in opposing the central canal were arguing against a proposition that will remove from them entirely the evil of which they are complaining, and that the steamship companies in proposing the new entry are remedying all the evils mentioned with the possible exception of those affecting the Superior docks.

From the standpoint of advantage to marine interests generally, the central canal appears to be the wiser project, especially in view of the comparative expense, for a breakwater such as proposed would almost be prohibitive in cost and because there is apparent a degree of uncertainty in the efficacy of the breakwater and a certain lack of logic in its construction under any circumstances. As regards the breakwater not accomplishing what it is intended for, it is admitted that the present current will be in no way affected but will continue to exist and it has been the current alone, —the cause of the Mataafa wreck,— which has made the entry difficult, for the captains who are generally credited as being the most experienced on the lakes say that otherwise the canal is not nearly so dangerous to enter even in a storm as many others, especially on Lake Erie. To have to maneuver around the end of a breakwater, placed as that will be, despite the 4,000 feet leeway, in the swirl and breaking of waves that is bound to exist there, will be but another peril added to those already existing. There is always a dangerous point in passing from the open sea into a harbor and that is not obviated by a breakwater. As for the boats hugging the north shore in time of storm, there seems to be little foundation for the statement. This may be true of the smaller craft which seldom venture out in stormy weather in any case, but surely the big fellows are anxious to stay out in the open sea as much as possible.

In conclusion it does appear lacking in logic to build a costly artificial breakwater outside of the much boasted natural breakwater, Minnesota Point. It has been said that Duluth is the only port on the lakes which has no breakwater, but what better protected basin could one ask for than St. Louis and Allouez bays. Let them be dredged out if deep water inside is not sufficient at present for where would the building of breakwaters cease if each one in turn is to be protected? And again, what assurance is there that the proposed new docks inside of the projected breakwater will not suffer the same disturbances that are now injuring the existing properties? Ordinarily the logical place for a harbor entrance is at the middle of the breakwater, centrally located with respect to shipping, and so the entrance to the combined port of Duluth-Superior should have been midway between Duluth and Superior, a central canal through Minnesota Point. The history of how reason was overlooked and the present Duluth canal cut through in a spirit of rivalry, more jealous than farseeing, despite extended litigation instituted by Superior interests, is too well known to need repeating. That the bay, acts as a tremendous siphon, with its opening at each end, allowing the wind to blow the water in at one entrance and pull it out of the other simultaneously, is only a small part of the result of that mistake, and it is to be hoped that the present board of engineers will consider well before recommending.

RECKLESS NAVIGATION.

The Ashtabula correspondent of the MARINE REVIEW sent in an article this week which is quite important, because it is at variance with a recent direct utterance of one of the prominent line managers. For that reason it is published as follows:

"Masters of the big ore carriers putting in at Ashtabula, in discussing the question whether line captains check their boats at any time, declare they do not do so on any occasion. Some of the complaining skippers can even specify the particular line boats which never check, not even for a fog. The captains, who are giving expression to what might be called silent objections, are withholding their names now, but

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they declare they will protest publicly if some relief is not obtained. They assert that their responsibility is too great to permit any recklessness. Two Pittsburg Steamship Co.'s captains who struck Ashtabula the latter part of last week appeared to be so certain the line skippers never check that they volunteered to give a $50 or $100 reward for finding such a man. They both sail big boats and they talked in vigorous language.

"Another thing, which the captains complain against, is the alleged carelessness on the part of captains of lumber tows. It is said the latter stick out so much line that when the steamer is up at Ballard's reef the last barge is down at Bois Blanc island in going over the crossing.

" 'You can generally keep track of the steamer,' a captain said, 'but you are not so sure of a barge keeping her course under such conditions. With a steamer of any size, you can see the danger. The lumber hookers should shorten their lines.'"

During the present year navigation has been hindered greatly by fog. Fog has been the rule rather than the exception during the season. It is known that certain leading vessel owners recognizing this have cautioned their masters and have directed them to carefully observe all rules making for the safety of navigation, especially the rule requiring three blasts every minute during foggy weather, the prompt acknowledgement of passing signals and the necessity of going under check during fog. Fortunately no serious accident has as yet occurred through collision in fog, but some have been narrowly averted. Strandings, however, have been numerous. Orders have been issued by owners to their masters concerning the handling of the ship in thick weather. Now it would be to the interest of all concerned if these masters who maintain that there are boats which never check would specify the boats and present direct evidence. The statement is really too important to be dismissed without further investigation.

The Tennessee River Navigation Co., Chattanooga, Tenn., has given an order to the Howard ship yard, Jeffersonville, Ind., for a steamer to be 165 ft. long, 32 ft. deep and with a draught of only 18 in.

AROUND THE GREAT LAKES.

Mr. R. Burgess who has been mate on the steamer R. S. Warner will go as mate on the steamer L. C. Hanna with Capt. M. Anderson.

The first cargo of coal to clear Buffalo for Port Sanilac this year was taken by the steamer W. P. Thew. She carried 280 tons.

The steamer Anna C. Minch loaded with coal, grounded on a boulder opposite the Big Four dock at Sandusky last week, blocking the channel.

Owing to the breaking of her steering gear, the steamer Lewiston, bound down with ore, ran aground on the east bank at Amherstburg this week.

The steamer James C. Wallace cleared from Ashtabula last week with 11,522 tons of coal, the largest cargo ever carried from that port.

W. K. Nesbitt, of Cleveland, mate of the steamer Senator, has been made master of that steamer vice Capt. W. A. Irvine, deceased.

Owing to the illness of Capt. H. B. Humble, of the steamer Mariposa, Capt. George B. Mallory has temporarily resumed sailing.

The steamer Wm. G. Pollock completed her maiden trip last week, taking a cargo of coal to Duluth. She made 11½ miles an hour on Lake Superior.

A new coast chart in colors of Lake Superior No. 6 including the Apostle islands has just been issued by the United States lake survey and is for sale by the MARINE REVIEW.

The new steamer Wm. G. Mather, of the Cleveland-Cliffs company's fleet, carried 10,525 tons of ore from Ashland to the Lackawanna company's plant at Buffalo on her last trip.

While passing beneath the draw of the Ohio street bridge at Buffalo the steamer Sacramento stuck and was released with difficulty, after her cargo was lightered.

Capt. J. M. Fields, compass adjuster for the Pittsburg Steamship Co., was in Ashtabula this week. He went out on the Sir Wm. Siemens to adjust her compass.

The two new lighthouses on the north harbor entrance pier at Milwaukee were placed in commission this week. The present wooden lighthouse will be torn down.

Horace Johnson has been appointed vice president and general freight and passenger agent of the Duluth & Iron Range railroad to succeed Augustus G. H. Viele, resigned.

Capt. E. C. Chaytor, formerly in command of the United States revenue cutter Algonquin, stationed at San Juan, Porto Rico, has been transferred to the Morrill, now at Detroit.

July coal shipments from Buffalo up the lakes amounted to 320,026 tons, which was in excess of the June shipments. In June 207,056 tons went up the lakes from that port.

Edward Bennett, who sailed the steamer Falcon last season, is making a good record for himself this year as mate of the steamer James Laughlin with Capt. Geo. A. Symes.

The name of the Ellsworth Transportation Co. has been changed to Pennsylvania-Ontario Transportation Co. with the capital stock of the company increased to $375,000.

The small Canadian passenger steamer Premier, plying between Kingsville and Pelee island, was discovered aground near Pelee this week. A tug was sent from Amherstburg to her assistance.

The steamer L. C. Smith, which stranded in St. Mary's river, is in the floating dry dock at the Ecorse yard of the Great Lakes Engineering Works undergoing repairs. She has eighteen damaged plates.

The new steamer H. H. Rogers, of the Pittsburg Steamship Co.'s fleet, cleared from Two Harbors last week with 11,480 gross tons of ore, drawing 19 ft. nine inches forward and 20 ft. two inches aft.

The barge Troy left Kenyon's ship yard, Marine City, last week in tow of the steamer Harvey Kendall. The Troy was in collision about a month ago in St. Clair river and received considerable damage.

The steamer Premier of the Windsor-Sandusky line has been chartered for the balance of the season by the Crystal Beach Co. of Buffalo. She is comparatively a new boat, 140 ft. long with 26-ft. beam.

The Merrill-Stevens Engineering Co., Jacksonville, Fla., is building the Jose Padre for Wm. E. Peck, of York City. The steamer will have a steel hull, will be 180 ft. long, 30 ft. beam and seven feet deep. She will be equipped with two engines, 12 by 29 in. cylinder diameters by 72-in. stroke, supplied with steam from two boilers seven feet five inches by 12 ft. The company is also building a steamer for Mr. W. R. Bryn, of Detroit, for use in Cuban waters. This steamer will be 75 ft. long, 18 ft. beam and four feet five inches deep. Steam will be supplied by a Taylor water-tube boiler.

The passenger steamer Missouri, through a mistake in signals, crashed stern first into a pier at Petoskey, breaking her rudder off short. She

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was towed from Petoskey to Chicago by the wrecking tug Favorite.

The steamer Joshua Rhoades, building at the Lorain yard of the American Ship Building Co. for Mr. W. H. Becker, of Cleveland, will be launched at noon Saturday and will be named by Miss Helen Bartow. Capt. Thomas Simmons will sail her.

Capt. John D. Green, of the Hawgood steamer Wisconsin, was taken sick at Ashtabula, Tuesday with a severe attack of hemorrhages. He was attended by Dr. Dorman, the marine surgeon at the harbor. Capt. Green belongs in Buffalo.

The Western Transit Co. has established a large lighter in Duluth-Superior harbor to transfer merchandise for the company's boats. The lighter is named Faith and was towed to the head of the lakes by the Amazones.

The steamer Henry B. Hawgood, ore laden, ran aground near the north pier, Buffalo, last Thursday. In a heavy fog she missed the channel. Her cargo was lightered and within a few hours she was able to proceed into port.

Boats are being held up at Ashtabula by the car shortage. The delays have not thus far been long, but they are noticeable on both the Pennsylvania and Lake Shore sides of the river. This is the earliest the shortage has been felt there.

The July lumber receipts at the Tonawandas exceeded all predictions. Figures compiled by the customs officials show that more than 62,000,000 feet of lumber was received. This exceeds the amount received in July, 1905, by 7,000,000 feet.

Capt. John Lowe will bring out the new steamer Peter A. B. Widener, now building at the South Chicago yard of the American Ship Building Co. for the Pittsburg Steamship Co. Capt. Lowe is master of the steamer Samuel F. B. Morse.

Napoleon Grignon, of Duluth, will attempt to recover the tug Alfred W., of the Duluth-Superior Dredging Co.'s fleet, wrecked on a reef near Pie island. He will obtain his wrecking outfit from the Great Lakes Towing Co. at Port Arthur.

Mr. Thomas Durkin, shore engineer of the Cleveland Cliffs Iron Co., has recovered from his illness and has returned to the yard of the Great Lakes Engineering Works where he is superintending the construction of the machinery for the steamer J. H. Sheadle.

Capt. Samuel B. Massey, of the steamer John Stanton, and Capt. John Massey, of the steamer G. Watson French were able to exchange fraternal courtesies at Ashtabula last week. It seldom happens that two brothers strike the same port at the same time.

Charles Thrasher, mate of the steamer Empire City, left her on the last trip down so he could proceed to Black Rock, N. Y., and move his family from there to Ashtabula, O. In his absence, John D. Oliphant will act as mate and Wm. McDonell as second mate.

The high-pressure cylinder of the White Star line steamer City of Toledo broke last week as she was turning around in Toledo harbor. She was towed to Detroit and will be repaired at the yard of the Detroit Ship Building Co. The steamer Sappho has been chartered to take her place.

Clarke Byers, Detroit, who has been acting as second mate on the steamer B. F. Jones will be given a mate's berth on that ship when Capt. F. T. Simmons leaves her to take charge of the new steamer Joshua Rhoades of the Becker fleet. Capt. Simmons has been acting as mate on the Jones.

The steamer John Harper, of the Gilchrist Transportation Co.'s fleet, struck an obstruction in Lake Erie near Colchester reef this week. The steamer had to be beached on Bar point to prevent sinking. Steam pumps were sent to her from the lighter Newman.

The steamer John Sherwin was in collision with the steamer Sahara as the former was coming out and the latter going into the Missabe ore docks at Duluth. The Sherwin's anchor was driven through the bow plates of the Sahara below the hawse pipes, but above the loading line.

A man prominent in the ranks of the lake seamen's union declared last week at Ashtabula that there are as many wheelsmen and watchmen working ashore for high wages this year as there are on the boats. The men on the boats are breaking all records by holding one boat down most of the season.

The steamer Crescent City was floated out of dry dock at Lorain on Wednesday of this week, making unusually good time, as 140 plates had to be removed and over 250 frames taken out and replaced. There is, of course, considerable work to be done on her yet, but the company expects to deliver her within ten days.

Business men at Ashtabula harbor and marine men whose boats put in there have expressed themselves lately against having the harbor part of the upper town of Ashtabula. They declare there is great confusion resulting from it. For prompt delivery, mail or anything else should be addressed to the harbor.

Capt. B. R. Walker, of the steamer Roumania, distinguished himself at Ashtabula last week by turning to in the galley to cook breakfast for his crew. The cook vamoosed the night before and the skipper served beefsteak, potatoes and coffee in his absence. The captain says everyone enjoyed the meal, but a cook was secured soon after.

One of Capt. Fred D. Galton's friends who was watching the steamer Moses Taylor pass up through the Ashtabula draw last week was heard to remark: "Captain Fred has been sailing on the lakes for twenty-six years and in all that time he has never had an accident. Love for the water was born in him because he ran away at an early age to go 'before the mast' on an old timer at Chicago."

Thomas P. Kelly, the oldest engineer in the fleet of the Cleveland Cliffs Iron Co., who retired last fall, has purchased a farm near Painesville. Mr. Kelley says that he has never worked so hard in his life as during the present year, getting up at 4 a. m. daily, but adding that he never slept more soundly or felt better in all his life. Mr. Kelly's last steamer was the Centurion. He was, in fact, part owner of the Kaliyuga and Centurion.

At a special meeting of the board of directors of the Detroit & Cleveland Steam Navigation Co. and the Detroit & Buffalo Transit Co., dividends of four and three per cent respectively were declared. The dividend of four per cent is a semi-annual declaration upon the stock of the Detroit & Cleveland line. The three per cent dividend is the first that has been declared upon stock of the Detroit & Buffalo line since it was started three years ago. This puts the latter stock upon a six per cent basis.

The United States court of appeals at St. Louis has just handed down its decision in the case of the owners of the schooner Thomas Gawn against the steamer John Harper, in which the former was awarded $3,200 damages. The Harper was towing the Gawn on the night of Nov 9, 1903, and tried to enter Duluth ship canal in a gale. The schooner landed against the south pier. Judge Morris, of the United States court at Duluth, awarded the Gawn $1,600, one-half the amount demanded. The court of appeals gives the Gawn the full sum.

The two ore unloading machines at the Hocking Valley dock at Toledo fell on the steamer Cadillac, of the

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Cleveland-Cliffs Iron Co.'s fleet, last week. Fortunately the injury to the steamer was slight. The Cadillac was directly under the rigs but the only injury sustained was the splintering of her rail cap and the staving in of two hatch covers. Her rail was below the level of the dock and consequently when the unloader fell it struck the dock first, breaking the force of the blow. Twenty men were working under the rig but managed to escape without injury.

A decision dismissing the libel of the Great Lakes Towing Co. against Worthington & Sill, marine insurance agents at Buffalo, has been handed down by United States Judge Hazel. The steamer Craig went ashore on Simmon's reef on July 25, 1903, and was abandoned to the underwriters. She was towed to Detroit by the Great Lakes Towing Co. who brought suit against Worthington & Sill to recover the cost of services. Judge Hazel holds that the firm were merely agents and that the services rendered were not on their personal credit.

All the steamers of the Cleveland-Cliffs fleet are now owned by a holding company known as the Grand Island Steamship Co., the capital stock being practically nominal. The three new steamers building for the company are being built entirely upon bonds, there being no issue of stock whatever. The bonds are guaranteed by the Cleveland Cliffs Iron Co., which makes them independent of the vessels' earnings. The bonds are redeemable annually in 10 per cent lots and therefore it is expected that the vessels will have paid for themselves in that time.

Mr. C. H. Menmuir, chief engineer of the steamer Michigan of the Cleveland Cliffs Line, has been transferred to the Ishpeming. Mr. Menmuir superintended the construction of the machinery of the Ishpeming during the last few days, just prior to her delivery from the builders. He was also on her trial trip and reported that the machinery behaved splendidly throughout the test. Mr. Menmuir was in the Andaste when Capt. C. E. Sayre commanded her. Both are together again in the Ishpeming. The Ishpeming went into commission on Saturday last.

One of the Pittsburg Steamship Co.'s greyhounds, the steamer Sir William Siemens, was equipped with a new idea in life lines last week at Ashtabula—new, at least, in so far as it has not been used on lake boats before. It consists of a cable aft of the pilot house running to the main mast with rings to which are spliced lines with a noose at the other end. The common idea of a life line is where a boatswain's chair is used by a sort of trolley from either end of the boat. This is already installed on several boats, including the Cleveland-Cliffs and Becker boats. The new idea is an improvement on this because it gives the crew a chance to save themselves in an emergency or to watch the hatches. The deck lines swing clear of the hatches. It is said the United States inspectors are urging this sort of safety appliance aboard ship in preference to the "trolley" idea, because it enables a skipper to send his men on deck to watch or fix the hatches with almost certain safety. With the "trolley" a man must go to either end before getting out. A noose at the end of the lines to run a hand through makes it impossible for a sea to carry a man overboard. The Siemens is in the greyhound class because she can knock off better than 9 miles with a big barge in tow, or 14 miles running light. She has done better than this, however, because she made the run from Presque Isle to Detour last season in 3 hours 6 minutes, a distance of 47 miles. Capt. M. K. Chamberlain is the Siemen's skipper, Thomas Zealand is mate and Wm. Dodge is second mate. Duncan McVicar and L. H. Smith are chief and second engineers. Norman Miller and Robert F. Pyette are wheelsmen on her.

AT THE HEAD OF THE LAKES.

Duluth, Aug. 6, 1906.—Grain at upper lake ports is getting well toward the bottoms of the bins. Trading is easing up, but shipping has been pretty active this week in wheat, oats and flax and promises to continue so through next week. The rate has remained at 2½ cents without variation. The receipts and shipments of grain from this port have been as follows for the past week:

	Receipts.		Shipments.	
	July 28	Aug. 4	July 28	Aug. 4
Wheat	198,012	244,691	626,134	756,077
Corn	6,701	3,923	204	34,057
Oats	312,509	253,300	315,575	524,672
Barley	150,305	144,108	62,526	142,679
Rye	5,881	17,782	....	1,343
Flaxs'd	505,323	428,377	426,149	635,346

The ore boats have been moving well though not unusually so. Just how big a month July has been at the head of the lakes in the matter of ore shipments is shown by the following record and comparison of the figures for the past month.

The figures show that July was ahead of any previous period of the same length and that the total shipments from the Vermillion and Mesabi ranges are a little more than a million in advance of last year's record. This is practically the gain in the total carried down the lakes as the lower ranges in the aggregate are not doing more than holding their own.

The steamers John Sherwin, of the Gilchrist Transportation Co.'s fleet, Capt. W. G. Stewart, and Sahara, of the Tomlinson line, Capt. C. C. Tousley, collided at the Missabe docks Thursday of last week and both boats were somewhat damaged. The Sherwin was loaded and coming out of the docks and the Sahara was light. In maneuvering to get in the dock the bow of the Sahara swung around and struck the bow of the Sherwin, driving the anchor of the Sherwin, which was hanging outside, through her bow plating, stoving quite a hole above the load line. The Sahara had a couple of plates bent. After being inspected the Sherwin proceeded on her trip.

The new suction dredge Enterprise, owned by the Duluth-Superior Dredge Co., left Duluth Sunday night in tow of the tug Schenck, Capt. Thomas Hogan, for Ogdensburg, a distance of 1,300 miles. This is the third dredge that the Schenck has towed to that port. The Enterprise is a 22-in. dredge, her hull is 120 by 40 ft. and she has triple-expansion engines of 900 H. P.

The Deutschland, of the Hamburg-American line, collided with a pier at Dover on July 13. The accident is attributed to the present unsatisfactory state of the harbor works and Dover will temporarily be abandoned as a port of call by the company. Hereafter the steamers of this company will call at Southampton.

	Two Harbors. Gross tons.	Duluth. Gross tons.	Superior. Gross tons.	Total. Gross tons.
July 21-31, '06.....	431,930	584,860	206,848	1,313,638
July 21-31, '05.....	405,756	440,174	258,270	1,104,200
Increase	26,174	144,686	38,578	209,438
July, 1906	1,288,625	1,783,086	917,761	3,989,472
July, 1905	1,210,916	1,304,828	885,588	3,491,332
Increase	77,709	388,258	32,173	498,140
June, 1906	1,176,982	1,656,831	885,588	3,719,401
Increase	111,643	126,255	32,173	270,071
Total to Aug. 1, 1906..	3,805,153	4,932,508	2,671,536	11,469,197
Total to Aug. 1, 1905..	3,766,993	4,114,376	2,519,991	10,401,360
Increase	98,160	818,132	151,545	1,067,837

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LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

BULKHEADS.

Fig. 3 shows bulkhead with a belt frame. The bulkhead plating is 12.5 lbs., stiffners 6 in. x 3½ in. x 15 lbs., channels and all other angles 3½ x 3½ x 8½ lbs.

The half bulkhead plan is laid down on the mold loft floor and molds are made for each plate, one mold each for horizontal and vertical stiffeners.

Two plates are marked from each mold for each bulkhead and all the stiffeners from one mold for the vertical and one for the horizontal channels.

The frame mold is used for both sides as well as other angles shown on plan.

Fig. 4 shows watertight division of tank. The plating is 15 lbs., frame angles 5 in. x 5 in. x 16.2 lbs. and other angles 3½ x 3½ x 8.5 lbs.

Molds are made similarly to the belt frame, also for the frames for the blacksmith work which are made and one-half of same riveted on to the floor before the frame is erected, the remainder of the watertight frames are put in as soon as the girders are erected. All the work around the watertight floors being carefully riveted and caulked before the same is covered in.

A mold is made for every piece on the bulkhead so that nothing is templated after the work is erected in place.

In Scotland the tank division, Fig. 4 would be laid down on the Scrieve board, the plating and frame angle of same marked, punched and put together. All the other work being done when the longitudinals are in place and riveted. Fig. 3, the bulkhead would be built in the vessel after the tank top and tank side are in place.

The angle connecting the bulkhead to the tank top and tank side would be put on and a template made on the ship to the shape of the bulkhead.

The plates would be laid out flat anywhere under cover and marked to the shape from the template obtained from the vessel.

The rivet holes for the laps, channels, etc., would be marked from templates drilled for that purpose, so that when the bulkhead has been laid out all the parts are punched and erected in place on the vessel. All smith work is done after the different parts are in place and riveted together.

The bulkhead work including the watertight parts completed in place ready for riveting would cost in Scotland one hundred and forty dollars for each bulkhead.

On the lakes with the mold system the cost would be five per cent less.

FRAME BEVELING.

There is the same practice nearly everywhere in frame bending and beveling. Some use machines, others do the work by manual labor. In every case care is taken to have the flange next the plating smooth.

The lifting of the bevels for the furnaceman, or frame bender, is different here than anywhere else and is very simple and useful for the style of construction.

Fig. 5 shows a mold made for the frame bender with the bevels marked on, viz.; 24, 24, 20, 16, 12, 8 and 4. The numbers represent quarters of an inch, the space between the frame lines on the floor or the difference in width of the frame farthest from midships.

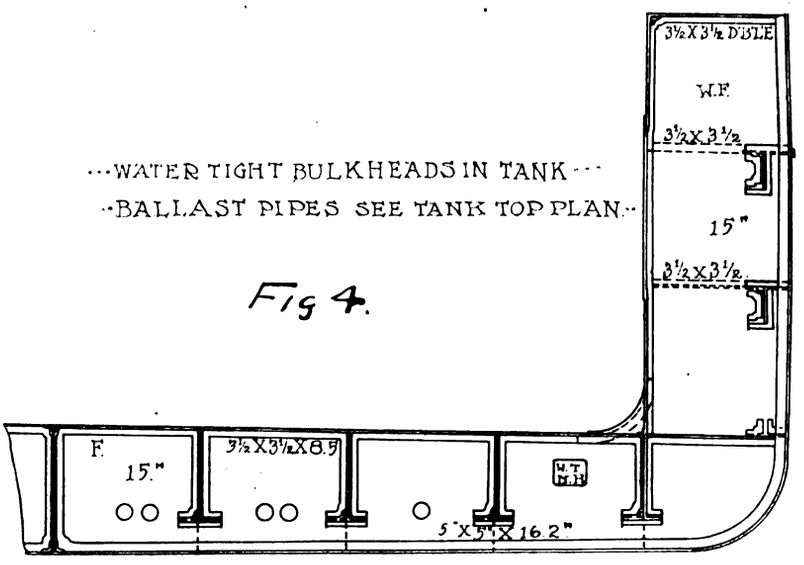

Fig 4.

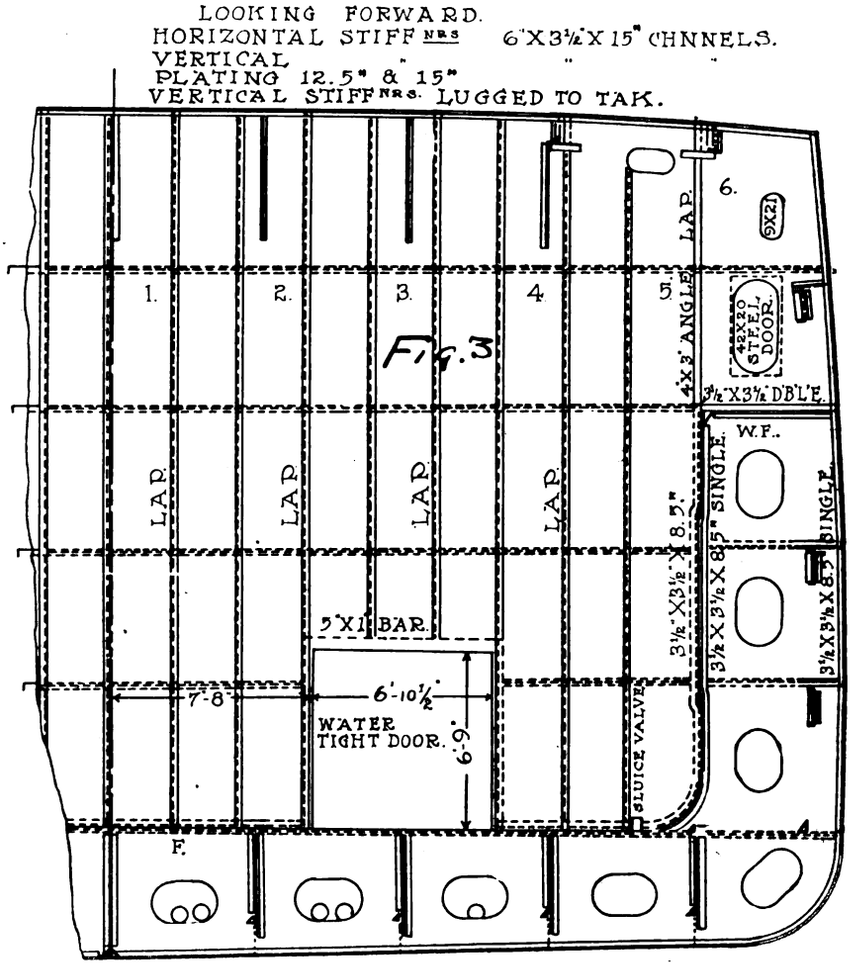

Fig. 3

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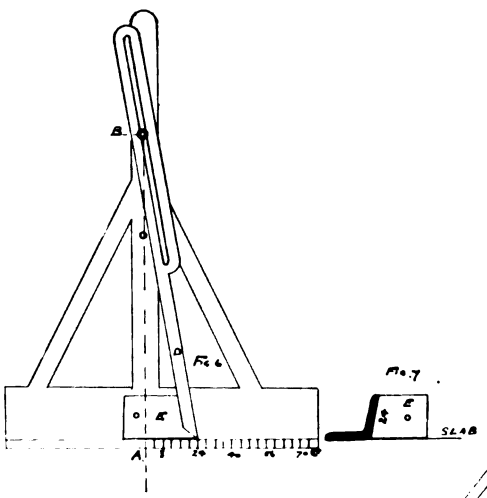
In this case twenty-four represents six inches and is equal to twenty-four quarters or approximately ten degrees in thirty-six-inch spacing of frames.

The method of obtaining the bevels for this practice is similar to others only a quarter of an inch is considered instead of the inch.

Fig. 6 shows a tool made of pine for the purpose of obtaining or registering the bevels for any frame spacing. In this case thirty-six inches being the frame space a hole is drilled at "B" thirty-six inches above "A" and a pin inserted which determines the frame spacing. From "A to C," is measured off in quarters of an inch representing the distance between the frame lines on the body plan.



"D" represents a movable bar slotted out as shown so that it can reach the numbers from "A to C," representing the difference of width at each frame towards the ends of the vessel.

E, Fig. 6 shows a piece of sheet iron placed on line "A C" and cut off to bevel at one end, as indicated by movable bar. Six inches is the difference equal to twenty-four quarters, which is marked on the sheet iron bevel and used always for a thirty-six-inch frame spacing.

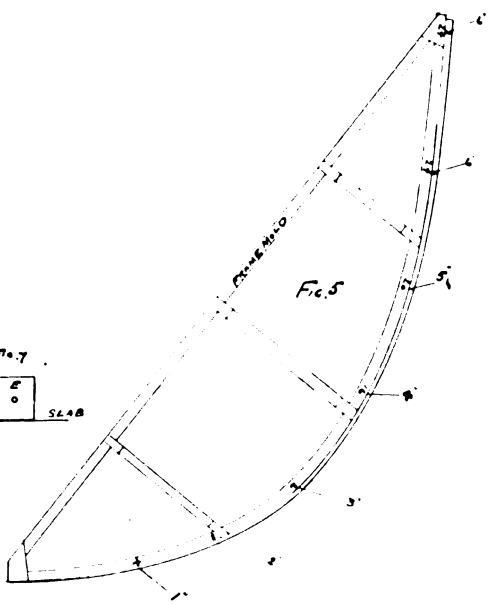
The bevel gauges are all made in this way from sheet iron, representing each number. Different frame spacing requires a different set of bevels. The bevels when not in use are hung on a nail near the furnace to be at hand any time they are needed.

Fig. 7 shows the bevel applied to a frame on the bending slab.

At the ends of this vessel the framing is spaced twenty-four inches apart so that two sets of bevels are required for a vessel of this kind.

After making one set of bevels for each frame spacing, there is no more work necessary in going through the process of bevel lifting, the numbers being simply marked on each mold at the plate edges, or anywhere for that matter, because the bevel number is marked on the slab when the mold is laid down to copy the shape.

This method of applying bevels on the bending slab simplifies matters in frame bending because unskilled labor can be more easily broken in on this work when complications are removed.



Although the process of checking the bevels is not resorted to here, yet very little trouble has been experienced in frame bevels when the shell plating has been put in place.

This practice has been in use here for a great many years and works like a charm.

The plant of the Neafie & Levy Ship Building Co., Philadelphia, has been ordered sold at public auction. The court has fixed the minimum selling price at $300,000, subject to the ground rental and mortgage indebtedness. All incompleted contracts with the exception of the cruiser St. Louis, will be turned over to the purchaser.

Capt. C. N. Cross, of the steamship Stanley Dollar, of San Francisco, has just been awarded a handsome medal in recognition of his services on a British transport during the Boer war from 1899 to 1902. He was an officer on the British transport Manchester Corporation at the time, and the medal presented by the English government, came through the hands of Consul-General Bennett at San Francisco.

SELF-STOWING ANCHORS.

The steamers John Sherwin, of the Gilchrist Transportation Co.'s fleet, Capt. W. G. Stewart, and Sahara, of the Tomlinson line, Capt. C. C. Tousley, collided at the Missabe docks, Thursday of last week, and both boats were somewhat damaged. The Sherwin was loaded and coming out of the docks and the Sahara swung around and struck the bow of the Sherwin, driving the anchor of the Sherwin, which was hanging outside, through her bow plating, stoving quite a hole above the load line. The Sahara had a couple of plates bent. After being inspected the Sherwin proceeded on her trip.

The above paragraph is taken from the MARINE REVIEW'S correspondence at the head of the lakes for the current week. It is just an ordinary news item and is not, in itself, especially significant. It is, however, potential as showing what may happen from projecting anchors. Underwriters are justified in maintaining that the major damage inflicted by this slight collision was avoidable. The Sahara swung around and struck the bow of the Sherwin. The impact must have been slight for it does not appear that the Sherwin was injured. Though the Sahara was the colliding vessel she nevertheless got the worst of the bargain, for the Sherwin's anchor, which was hanging outside, was driven through her bow plating, stoving a hole above the load line. Had the Sherwin's anchor been stowed, the Sahara probably would not have been damaged at all.

Capt. J. V. Tuttle, of the Great Lakes register says that since stockless anchors were introduced on the lakes one hundred such accidents have occurred; Mr. A. H. Langell, insurance agent of the Pittsburg Steamship Co., says that the list is nearer one thousand. In fact, the little item at the head of the column is merely singled out to show how ordinary this form of accident is. Of course, in this case it is minor, but ships are not infrequently sunk by this form of accident. When the Saxona and Zimmerman collided in St. Mary's river last spring the Saxona would have escaped without much injury had it not been for the Zimmerman's anchor which went through her bow, causing her forepeak and forward compartments to fill with water. She had to be beached in order to prevent her from sinking in deep water. The hole made by the Zimmerman's anchor was so big that a log had to be sawed and jammed into it. This was then made tight with tallow and boarded up and in that manner she was taken to Sault Ste. Marie where a plate was put on before the journey to Buffalo was undertaken.

A year ago last spring while the Cambria was in the ice above Whitefish point a steamer brushed by her and cut out thirty frames with her anchor. Last summer the steamer Sylvania raked the steamer Sir Henry

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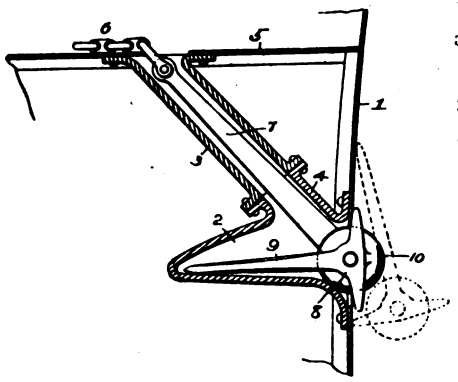
Bessemer on Lake Superior for a considerable length, tearing a hole 72 ft. long and 2½ ft. wide in the side of the Bessemer, carrying with it frames and all along the length of the break, entailing damages amounting to $15,000. The steamer Mary C. Elphicke raked the side of the steamer Poe in St. Mary's river, inflicting $5,000 worth of damage. It was the anchor of the steamer Maunaloa that sank the whaleback barge 129 on Lake Superior. The anchor of the barge Maia tore the side of the steamer Wm. E. Reis at Two Harbors. The steamer Edwin F. Holmes tore the cabin side out of the passenger steamer America at Duluth with her anchor. The anchor of the steamer Admiral inflicted serious injuries to the steamer Mariposa. The list, if there were space to go into it in detail, of accidents resulting from this cause, is very large. Moreover, there is a great deal of annoyance caused by seas striking the anchors and water rushing up the hawse pipe into the windlass room. In many cases the anchor has to be dropped out to avoid damage to the docks in making a landing. In case of collision the old style of projecting anchor is an ever-present source of danger and is so recognized by all captains and vessel owners.

No practical attempt was made until lately to perfect a device which would eliminate the danger due to the projecting of the anchor from the ship's side. Last year Capt. Joseph Kidd, of Duluth, turned his attention to the problem and devised a patent anchor pocket and hawse pipe for stowing anchors and bringing the big flukes within the ship, having the butt almost flush with the side plating and in line with the fender strake. The Great Lakes Engineering Works, of Detroit, installed the device experimentally in the steamers Frank C. Ball and Wm. P. Snyder. The company has since worked out the problem to a thoroughly satisfactory conclusion and it believes that the results which it has obtained justified it in making the announcement that the old anchors with all their dangers are a thing of the past. It has acquired the rights to the device and has lately arranged for its installation upon a royalty basis upon vessels that are building at other ship yards. While the Frank C. Ball and Wm. P. Snyder as yet are the only two vessels on the lakes that have the anchor pocket, it is quite likely that the majority, if not all, of the vessels that will be built hereafter will be equipped with it. It is to be installed on the steamer J. H. Sheadle, now building at the Great Lakes yard. The accompanying illustration as well as the one published in the Great Lakes Engineering Works advertisement in this issue is self-explanatory and clearly shows the object attained by this invention.

No. 1 in the drawing represents the hull of the vessel, having an opening in its side communicating with the improved anchor pocket, No. 2, of metal, preferably cast, and of the general



shape shown, which is secured by bolts or otherwise to the ship's side. The hawse-pipe, 3, communicates with and is secured to a neck, 4, of the pocket and at its upper end is secured to the deck, 5. Six represents the hawse or anchor chain secured to the end of stem, 7, of the anchor, 8. The anchor is of that character, having the stem pivotally connected with the arms carrying flukes, 9, and the latter are of the ordinary "T" shape, and the arms join a spherical enlargement, 10, between them to receive a ball of stem, 7, and form a pivotal connection.

In operation the chain is wound on the windlass, drawing up the anchor until the stem, 7, is drawn up into the hawse-pipe, 3. A continued upward pull of the chain will draw the long members of the flukes into the pocket, 2, and the shorter members thereof and the arms against the ship's side, closing the pocket. When the anchor is in this position, the flukes will rest on the approximately flat bottom of the pocket and be supported therein and the anchor held against movement but when the windlass permits the unwinding of the chain the anchor will of its own weight fall out of the pocket and can be lowered without difficulty.

John Lucas & Co., of Philadelphia, announce that under the provisions of the deed of trust between Wm. H. Lucas, Albert Lucas and of the will of the late Wm. H. Lucas, the business of the company will be conducted under the old name as heretofore.

The Moran Co., Seattle, will build a steel steam schooner for the Northwestern Steamship Co.

IMPROVING MANITOWOC HARBOR.

Major W. B. Judson, corps of engineers, with headquarters at Milwaukee, opened bids last week for removing the old piers and building pile piers at Manitowoc Harbor, Wis., on July 30. Greiling Bros., of Green Bay, Wis., and P. F. Nelson, Muskegon, Mich., were the only bidders. The amount available for the work was $75,000, but the bid of Greiling Bros., amounting to $81,785, was nevertheless recommended. The bids in detail were as follows:

Number of Proposal	1	2
Name and Residence of Bidders.	Greiling Bros., Green Bay, Wis.	P. F. Nelson, Muskegon, Mich.
Removing 1,475 lin. ft. old crib piers, per lin. ft.	$11.00	$22.00
26,800 lin. ft. Round Piles, per lin. ft.	30 cents	35 cents
507,000 ft. B. M. Sheet Piling, per M. ft. B. M.	$40.00	$60.00
242,000 ft. B. M. Pine Timber. Per M. ft.		
White Pine Timber	$45.00	.....
Douglas or Oregon Fir Timber	$45.00	$57.00
Long leaf Yellow or Southern Pine Timber	$47.00	$57.00
Norway Pine Timber	$45.00	$56.00
22,000 ft. B. M. Pine Plank, per M. ft. B. M.	$40.00	$45.00
2,600 pounds Wrought Iron Drift Bolts, per pound	5 cents	4 cents
82,000 pounds Wrought Iron Screw Bolts and Tie Bolts per pound	6 cents	5½ cents
7,000 pounds Wrought Iron and Wire Spikes, per pound	6 cents	6 cents
20,000 Tons Stone, per ton of 2,000 lbs.	$1.00	$1.30
Total of bid using 242,000 ft. B. M. White Pine Timber	$81,785.00	.....
Total of bid using 242,000 ft. B. M. Douglas or Oregon Fir Timber	$81.785.00	$118,068.00
Total of bid using 242,000 ft. B. M. Longleaf yellow or Southern Pine Timber	$82,269.00	$118,068.00
Total of bid using 242,000 ft. B. M. Norway Pine Timber	$81,785.00	$117.826.00

MUD LAKE DREDGING BIDS.

Col. Charles E. L. B. Davis, government engineer with headquarters at Detroit, opened bids on July 11 for dredging Shoal 28 in Mud Lake, St. Marys river. The bids, which were all rejected, were as follows:

G. H. Breymann & Bros., Toledo, O.	25c per cu. yd.	$26,625.00
James Pryor, Houghton, Mich	36c " " "	$38,340.00
Great Lakes Dredge & Dock Co., Chicago, Ill.	36½c " " "	$38,872.00
Edward Bros., Sault Ste. Marie, Mich.	38c " " "	$40,470.00
Lake Erie Dredging Co., Buffalo, N. Y.	39c " " "	$41,535.00

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COMMERCE OF LAKE SUPERIOR.

The commerce of Lake Superior, as measured by the canals at Sault Ste. Marie, was heavier during July than any previous month in the history of the lakes. The freight which passed through the canals aggregated 7,732,771 tons, a gain of over 1,000,000 tons over the corresponding month last year. Of this commerce 6,273,734 tons was east bound and 1,459,037 tons west bound. The total movement to Aug. 1 of the present year has been 22,610,551 tons as against 19,837,204 tons for the corresponding period in 1905.

The coal movement is unusually heavy, exceeding the movement of last year to Aug. 1 by 734,904 tons. The grain movement too is prodigious, more than trebling the movement of last year. Following is the summary of the canal statistics to Aug. 1 with corresponding data for 1905 and 1904:

MOVEMENT OF PRINCIPAL ITEMS OF FREIGHT TO AND FROM LAKE SUPERIOR.

Items	To Aug. 1, 1906.	To Aug. 1, 1905.	To Aug. 1, 1904.
Coal, anthracite, net tons	321,857	436,972	350,768
Coal, bituminous, net tons	3,248,505	2,513,601	1,208,211
Iron ore, net tons	16,018,806	14,856,053	4,963,739
Wheat, bushels	26,280,985	13,607,165	15,699,162
Flour, barrels	2,230,698	1,640,848	1,075,100

REPORT OF FREIGHT AND PASSENGER TRAFFIC TO AND FROM LAKE SUPERIOR, FROM OPENING OF NAVIGATION TO AUG. 1 OF EACH YEAR FOR THREE YEARS PAST.

EAST BOUND.

Items	To Aug. 1, 1906.	To Aug. 1, 1905.	To Aug. 1 1904.
Copper, net tons	52,057	45,735	34,033
Grain, other than wheat, bushels	22,588,941	10,711,366	7,278,334
Building stone, net tons	640	7,038	4,227
Flour, barrels	2,230,870	1,633,028	1,075,100
Iron ore, net tons	16,018,806	14,856,053	4,963,739
Iron, pig, net tons	14,215	31,305	13,317
Lumber, M. ft. B. M.	420,285	424,985	343,016
Silver ore, net tons			919
Wheat, bushels	26,280,985	13,607,165	15,699,162
Unclassified freight, net tons	74,149	44,158	39,912
Passengers, number	12,456	12,128	7,053

WEST BOUND.

Items	To Aug. 1, 1906.	To Aug. 1, 1905.	To Aug. 1, 1904.
Coal, anthracite, net tons	321,857	436,972	350,768
Coal, bituminous, net tons	3,248,505	2,513,601	1,208,211
Flour, barrels	234	1,175	
Grain, bushels	6,749	63	625
Manufactured iron, net tons	172,420	52,518	46,762
Salt, barrels	207,673	224,720	169,258
Unclassified freight, net tons	449,050	309,691	201,451
Passengers, number	14,233	13,727	7,598

SUMMARY OF TOTAL FREIGHT MOVEMENT IN TONS.

	To Aug. 1, 1906.	To Aug. 1, 1905.	To Aug. 1, 1904.
East bound freight of all kinds, net tons	18,386,401	16,490,111	6,356,669
West bound freight of all kinds, net tons	4,224,150	3,347,093	2,841,534
Total freight, net tons	22,610,551	19,837,204	9,198,203

Total number of passages to Aug. 1, 1906, was 10,451, and the registered tonnage, 18,368,892.

FREIGHT SITUATION.

Assuredly lake trade was never in better condition than now. All vessels, both large and small, are actively employed with conditions steadily making for greater firmness in the market. An enormous quantity of coal is going northward, the movement to Aug. 1 being nearly 2,000,000 tons greater than that for the similar period last year. Hard coal shippers at Buffalo, who usually send the bulk of their coal wild, have been compelled to offer an advance at ten cents in order to move that commodity. The rates are therefore 40 cents to the head of the lakes and 50 cents to Milwaukee. A number of big carriers were placed at this figure, but more would have been placed had they been available. There has been for some time past a scarcity of boats in the coal trade at Buffalo. The soft coal rates at other Lake Erie ports was immediately advanced to meet the Buffalo rate but practically no vessels were available at the advanced figure. Ore rates are steady and will probably continue so. Shippers cover their ore requirements quite completely by contract, though more ore is moving wild this year than last. However, no one expects any change in the ore rate for some time. The grain rate is steadily stiffening and a fancy price will probably be paid to move this commodity later, in the fall.

The Mexican government has decided to spend $14,000,000 on the improvement of the harbors of Salina Cruz and Coatzacoleos.

IRON ORE SHIPMENTS.

Ore shipments during July were 5,762,722 tons, a gain of 538,152 tons over the shipments of July, 1905. To August 1 of the present year 17,004,368 tons have been moved, as against 16,038,674 tons to Aug. 1, 1905, a gain of 965,694 tons. Last year the lake shipments of ore were 33,476,904 tons, half of which would be 16,738,452 tons. As 16,038,674 tons were moved to Aug. 1, 1905, it can be seen that it was approximately half the total movement by lake. It is reasonable, therefore, to consider the movement up to Aug. 1 of the present year as approximately half of the present season's movement. This calculation brings the lake movement for 1906 to a trifle in excess of 34,000,000 tons. If, therefore, 36,000,000 tons are to be moved, which was the conservative estimate earlier in the season, ore will have to move during the balance of the season considerably faster than it has been moving. The average vessel tonnage is easily 3,000,000 tons greater this year than last, and the loading and unloading records show that it has been receiving reasonably good dispatch, yet it is falling behind in moving the normal increase of 1906 over 1905. The reason for this defection is to be found elsewhere. There is, first of all, a greatly increased movement of coal, which is keeping many vessels busy, and there is also a shortage both of cars and locomotives on the railways leading to the mines. The rolling stock was taxed to handle last year's movement, and what with the delays incident to bad weather, the equipment is not now equal to the demand upon it. It will probably require the addition of the all-rail shipments to bring the 1906 movement of ore up to the 36,000,000-ton figure as predicted. Following are the ore shipments by ports for July and for the season up to August 1 with data for the corresponding periods last year.

Port and Dock	July 1905	July 1906	To Aug. 1, 1905	To Aug. 1, 1906
Escanaba	784,242	827,097	2,521,613	2,565,565
Marquette	442,593	451,807	1,140,536	1,254,694
Ashland	521,915	490,586	1,647,167	1,679,359
Superior	832,626	917,761	2,467,629	2,671,536
Duluth	1,408,917	1,801,086	4,155,935	4,982,531
Two Harbors	1,231,327	1,274,415	3,786,404	3,850,963
	5,224,620	5,762,772	16,038,674	17,004,368
1906 Increase		538,152		965,694

Rear Admiral Charles J. Train, commander-in-chief of the United States Asiatic fleet at Che Foo died this week. He was sixty-one years of age and would have retired from active service next May. He was appointed to the naval academy from Massachusetts.

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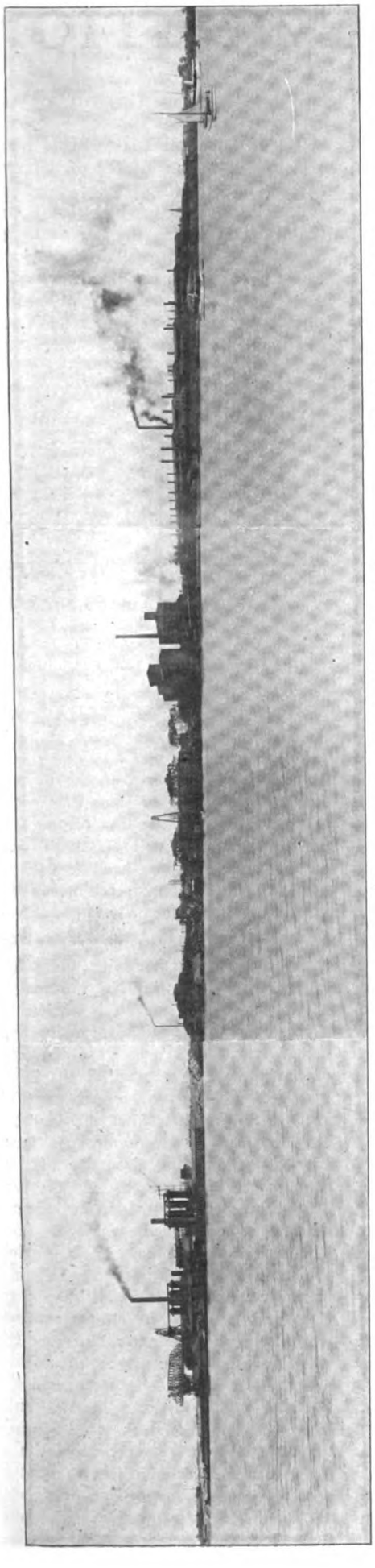

TOLEDO BLAST FURNACE. MARINE BOILER WORKS. TOLEDO SHIPBUILDING CO. NATIONAL MILL. MALLEABLE CASTINGS CO.

TOLEDO'S WATER FRONT.

The panoramic photograph on the present page shows very clearly how the river front at Toledo is building up with important industries. The National Malleable Castings Co. is one of Toledo's oldest and soundest industries, employing from 1,200 to 1,500 men. Adjoining it is the National Mill, for many years the greatest winter wheat mill in the world with a capacity of 4,000 barrels of flour per day. Then comes the yard of the Toledo Ship Building Co., now undergoing improvements which will make it among the most complete yards on the lakes, with capacity for docking the largest steamer or even the widest passenger boat without removing guards. This yard is being literally transformed since it was acquired from the Craigs and as a ship yard will be entirely self-contained. The Marine Boiler Works adjoins the plant of the Toledo Ship Building Co. Then comes the Toledo Furnace Co.'s yard, the pioneer company in the manufacture of pig iron in Toledo. This plant is now undergoing extensive additions. The new D., T. & I. ore and coal docks are now being constructed just below the blast furnace. Below the D., T. & I. docks is the Wheeling & Lake Erie railroad's property, with docks at Ironville, Gillmore's Shipyard, the Paragon Oil Refinery, the Lake Erie-Ashville Block plant, the Fishhack Plaster plant, Shepler's paper mill and the Craig Oil Refinery. Then comes the stretch of property purchased last year by the Cleveland Cliffs Iron Co. for future development. The property extending along the water front from Cherry street bridge to the Malleable Casting Co.'s plant is controlled by railroad interests. In fact, practically the whole water front at Toledo has been acquired by corporations who realize its great industrial value.

LAKE CHANNEL.

The work of constructing a 20-ft. channel in the connecting rivers of the great lakes was begun in 1893 and has continued since. The total amount of money expended in the work to date has been $3,259,503.60. In the improvements in St. Mary's river including the west and middle Neebish and Hay lake, the sum of $5,050,655.61 has been expended to June, 1906. The artificially improved channel in St. Mary's river between Lake Superior and Lake Huron is now 22½ miles long, making a navigable route 11 miles shorter than the old route through Lake George. The sum of $1,912,523 is needed to complete these improvements. The sum of $1,035,577.28 has been expended to date on the St. Clair Flats canal and a new channel is now under construction there. The original depth at the Lime Kiln crossing varies from 12 ft to 15 ft. over a bottom of solid rock. The sum expended to date in deepening the water over the crossing has amounted to $2,762,254.47. Concerning the 20-ft. channel, Col. Charles E. L. B. Davis in his annual report says: "The improved channels were made available in 1897, but as the water levels have been almost continually below the mean stage as determined at the beginning of the work, the actual navigable depth has been from one to three feet less than 20 ft."

A survey has been made to determine the cost of deepening the channel to 22 ft. and 25 ft. A 22-ft. channel can be constructed for $7,738,970. A 25-ft. channel would cost $25,938,367.

Mr. E. S. Wheeler, assistant to Col. Davis, very ingeniously arrives at the total commerce of the Detroit river. He takes the freight movement through Sault Ste. Marie canal, 44,270,680 tons, and compares it with the registered tonnage of the canal. Then he takes the registered tonnage of vessels passing Detroit, which can very readily be done through the post office department, and gives to it the same ratio of freight carried as of St. Mary's canal. He therefore determines the commerce of the Detroit river as 55,508,000 tons for the season of 1905.

In the improvement of lake channels the general government has forged ahead of the municipalities. The depth of water in the inner harbors at the various receiving ports does not correspond to the depth in the connecting rivers. The government has undertaken the work of deepening a couple of the outer harbors at Lake Erie ports to 25 ft., but the inner harbors, which are under the control of the cities, are comparatively shallow.

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SCIENTIFIC LAKE NAVIGATION

By Clarence E. Long

THE LAWS OF MAGNETISM.

SUGGESTIONS TO THE STUDENT AS TO METHOD OF STUDYING MAGNETISM.

This lesson is intended to be self-explanatory; help from a teacher being unnecessary.

The student should first read over several times with due thought and deliberation Part I of the "Laws of Magnetism" (Magnetism by Theory), before taking up the experimental study of the science, or the practice of its art, which is contained in Part II. By following this method closely the student will obtain a theoretical knowledge of the fundamental principles of the science by simply reading the lesson over a few times, and weighing in the mind its laws, rules and principles, thus forming a true and satisfactory solution tending to explain and clear up the seemingly perplexing laws that constitute the essential part or foundation of any science.

This is the correct course for the student to pursue in obtaining the necessary axis or groundwork, so essential to the thorough and comprehensive understanding of the study.

The law governing the principle of the experiment to be performed is first explained, and then comes the experiment itself, or the theory put to practice. The student must think; and, therefore, when he gives the statement of a principle, he has the knowledge of actual experience behind that statement.

Such a knowledge will prove helpful to the student in the practical solution of all theoretical problems thus learned, as well as by their experimental demonstration.

It is the theoretical part of my study that the beginner needs first. Practice will avail little or nothing unless it be founded upon correct theoretical principles, and these principles understood by the student.

Theory is founded on principles which have been established on independent evidence. The science distinguished from the art; the rules of an art, as distinguished from the practice.

Practice is the capability of reducing knowledge or theories to actual use or experience, not visionary. Opposed to theory. Taught or instructed by practice, use, or experience; having derived skill from actual work or experience.

Theory is of little account unless closely associated with practice. Much, of course, can be accomplished by practice alone, but more when accompanied by theory. One is the essential of the other, and without the two together one can never hope to be thoroughly proficient in acquiring a full and correct knowledge of any special branch of study; and without first clearly comprehending the laws upon which a theory is based, it cannot be performed in practice with any degree of certainty or satisfaction.

All theories, when possible, should be put into practice.

There will probably be many laws and principles in the theoretical study of magnetism that will at first tend to puzzle the student in reaching a satisfactory explanation of same. Should this at any time occur, after giving it careful thought and reflection, either throw it from the mind entirely for the time being and take up another subject that will gradually lead to the one just dropped, or take the same subject up in the experimental study of the science. By experiment, in nine cases out of ten, a solution will be reached where the same laws and principles were meaningless theoretically. This is likewise true of theory, and the student in many cases will be able to grasp a meaning theoretically, even if he does not actually perform the experiment for himself. One is a stepping stone to the other.

Starting aright is of primary importance to the beginner in pursuing a course of study, and much depends on this point of elementary knowledge in the attainment or accomplishment of the object sought, i. e., a full and complete knowledge by the student of the elementary facts and laws of the art he is studying.

Familiarity with the rudimentary truths of the study of such an art is the source from which all knowledge is derived.

The above facts show the necessity of an elementary training in order to give the mind a harmonious development, and preparing it to acquire all kinds of knowledge.

The processes of every art are based on principles, and these when formulated become its rules, and hence a complete knowledge of an art includes a knowledge of its guiding principles. These principles are of little, if any, value to the learner unless brought out one by one, and reached by an analysis of familiar processes and by the study of the productions that embody them.

No mistake in the elementary teaching is more absurd or fetile, than the attempt to learn an art by simply learning a theoretical knowledge of the principles and processes. The mastery of an art involves the acquisition of skill, and a knowledge of the art is chiefly valuable as a means to this end. Theory without practice cannot impart skill, and hence cannot make an artist.

The study of any branch of physical science increases one's power to master any other physical science. It is also a fact that the study of a branch of knowledge that trains several powers of the mind may increase its capacity to master other branches that appeal to these powers.

Learn to think and to think correctly is an important factor in the study of any art. One does not learn to think by mere thinking, but that he learns to think correctly by the thinking under guidance. There are many guiding posts in the lesson following so that the student will have every chance and opportunity of thinking correctly.

Learn to be observing; train yourself to be observing by cultivating the mind in that direction. Think for yourself, and reason for yourself; do not have, or expect, someone else to do it for you; and above all learn to rely upon yourself. These are necessary requirements for the student to acquire for a firm basis on which to build beneficial and lasting knowledge.

The student should make it a point to investigate the "whys and wherefores"—the causes and effects of the various laws and principles involved in the different subjects so that he may intelligently understand what he is doing and why it is done. Never learn rules or laws parrot fashion. Learn the principles, then, if possible, make your own rules. If you know why you are doing a certain thing you can always give a reason; this reason then should be your rule. Such rules will be living and lasting rules, not easily forgotten.

The student should not become discouraged if he is unable to grasp the meaning of each law or principle at first sight. They are much simpler than they appear at first. Remember that this planet on which we live was not made in one day.

Go slow and begin at the beginning. Be sure to do everything thoroughly that is done. Always keep in mind what you have learned in your previous lesson.

Magnet.—A body possessing that peculiar form of polarity found in nature in the loadstone; a body capable of exerting and being acted on by magnetic force. Every such body has at least two opposite points or poles, each of which attracts one pole and repels the other of another magnet. Poles that are all attracted or all repelled by the same pole (hence called like poles) repel each other; those affected oppositely by the same pole, called unlike poles, attract each other. A magnet induces magnetism in other bodies capable of becoming magnets, especially iron or steel, and therefore attracts them, but it exerts its peculiar action only upon bodies which have magnetic properties. The earth acts like an immense magnet, of which the respective poles are within the arctic and antarctic circles, and hence causes a suspended magnet to point in the direction of them, which is nearly north and south. The end that points north is called either the *north, north-seeking, positive* or *red* pole; the other, the *south, south-seeking, negative,* or *blue* pole.

Magnets are either *natural,* when like the loadstone they are found already magnetized, or *artificial,* when magnetism has been given to them by placing them in the field of another magnet or in that caused by an electric current. They are permanent when the magnetism remains after they have been removed from the exciting field. Permanent magnets are those made of highly tempered steel, and practically the only magnetic substances are soft iron, and some of its oxides.

MAGNETISM BY THEORY.

PART I.

An exhaustive inquiry into this most important subject must involve a whole book on it alone, whilst in these pages we can afford it but a few chapters. The object of these notes is to make known a plain and simple method of determining its effect on the magnetic needle. It is also intended to show that a practical knowledge of the law of magnetism can be easily acquired by any master or pilot, and thence the theory of the deviation of the compass and compass adjustment, or still better, compass compensation. It is absolutely necessary to have an understanding of the principal features of the theory since it is certain that anyone who attempts compass adjustment by mere "rule of thumb" without first clearly comprehending the laws upon which it is based, can never hope to perform it satisfactorily.

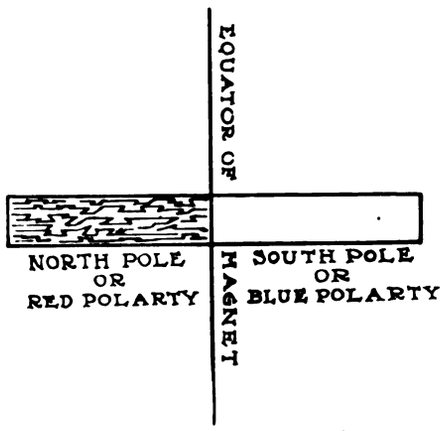

FIG. 1.—POLES AND EQUATOR (NEUTRAL LINE) OF A SIMPLE BAR MAGNET.

THE ORIGIN OF THE MAGNET.

Before going further with this subject let us trace the origin of the magnet. The magnet was not an invention, but a discovery. Little is known of its origin though the Chinese claim the distinction of having first discovered, both its attractive and pointing properties. The ancients were aware that the loadstone attracted iron, but were for ages, ignorant of its directing property. It was through the loadstone that the discovery of the magnet was made, and upon it the laws of magnetism are based. Loadstone is the natural magnet. It is mined the same as ore of iron to which it is closely related. It is in all shapes and sizes and is found in all parts of the world. It was the natural magnet that was first used as the magnet of the compass. After this it was discovered that by rubbing the natural magnet on a piece of tempered steel, it too became magnetic and had all the properties of the natural magnet; that is, two magnetic poles of opposite magnetism, or a north and south pole of magnetism. The latter

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magnet is called the artificial magnet, and its use has entirely superceded that of the natural magnet. This is because the artificial magnet can be made into a more convenient shape and given greater magnet power. The artificial magnet is an invention. The discovery of the

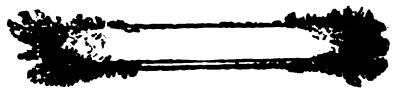
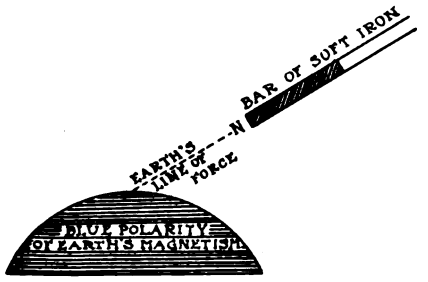


FIG. 2.—A BAR MAGNET WITH IRON FILINGS ADHERING TO IT.

natural magnet was possibly made through finding pieces of the loadstone attached to one another (small pieces to large pieces). It was centuries after this that it was discovered that such stones had the still more remarkable property of pointing north and south when floated on a piece of wood. It was then that the pointing power of the magnet or loadstone, was turned to advantage in navigation. The floating compass was the first device of this instrument. If a piece of loadstone or an artificial magnet be fastened to a cork floating upon a basin of water, it will, in a short time, settle in a north and south direction; and, indeed, at the time of its introduction into Europe, about the middle of the 13th century, it was all there was of the mariner's compass. Anyone can try the experiment of floating a magnet on a cork or piece of wood and prove for himself this statement.

Magnetism.—Magnetism is that branch of physical science which treats of the nature and properties of magnets and of their action on each other. The term magnetism is also used to designate the force which produces the effects called magnetic. Magnetism is an invisible fluid without sensible weight, and so very subtle that it pervades all bodies capable of being magnetized.

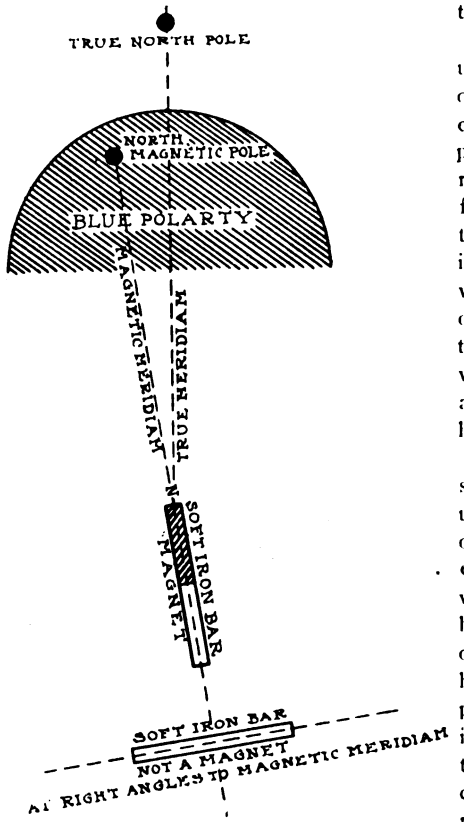
The term magnet was given by the ancients to certain black stones found in various parts of the world, notably at



SHOWING HOW A BAR OF IRON BECOMES MAGNETIZED BY INDUCTION FROM THE EARTH'S POLARITY.

Magnesia in Asia Minor, which possessed the property of attracting small pieces of iron and steel. This magic property as they deemed it, made the magnet stone famous; but it was not until the tenth or twelfth century that such stones were discovered to have the still more remarkable property of pointing north and south when hung up by a thread. This property was turned to advantage in navigation. Its various names are interesting. In Pliny's time is was called ferrum (quick iron); the Chinese knew it as tchu-chy (the directing stone); and similarly in Swedish it is sequel-sten (the seeing stone); in Icelandic, liederstein (the leading stone), and in English the loadstone (from Sax., to lead).

Every magnet whether natural or artificial, has two poles and a neutral line. The poles, called north and south poles are at the extremities of the magnet and



SHOWING HOW A BAR OF SOFT IRON HELD IN THE MAGNETIC MERIDIAN BECOMES A MAGNET BY INDUCTION. ALSO HOW THE SAME BAR OF IRON LOSES ITS MAGNETISM WHEN HELD AT RIGHT ANGLES TO THE MAGNETIC MERIDIAN.

these portions are where the magnetic attraction is the greatest, and the neutral line or equator of the magnet will be about the center of the magnet. This is also called the dividing line, which separates the north and south polarity, or magnetism, from each other. At the middle portion of the magnet there is no nagnetic force, hence its name—neutral point.

The natural magnet, called loadstone, is exceedingly rare, although closely related to ore of iron, is of a dark gray color, and is found in Sweden, Norway, Spain, Arkansas and the Isle of Elba.

What is known as an artificial magnet, is when a piece of steel, which has been properly hardened and tempered, is rubbed with a piece of loadstone, or by another magnet, or when a current of electricity is passed around it by means of a coil of insulated wire, it becomes a more or less powerful magnet. Artificial magnets are permanent or temporary (depending on whether the iron or steel is hard or soft) as they retain their magnetism after being removed from the source by which they acquire it. The needles or bars of steel in the mariner's compass are artificial magnets. Artificial magnets have identically the same properties of the natural magnet—two poles and a neutral line.

The property of attracting iron is very unequally manifested at different points of the surface of the magnet. If, for example, an ordinary bar-magnet be plunged in iron filings, these become arranged around the ends of the bar in feathery tufts which decrease towards the middle, which is bare. If the magnet is very thick in proportion to its length, we may have filings adhering to all parts of it, but the quantity diminishes rapidly towards the middle. The middle portion where there is no visible magnetic force, and to which the filings refuse to adhere, is the line of no magnetic force.

Magnetic Needle.—Any magnet freely suspended near its center of gravity is usually called a magnetic needle. One of its most usual forms is that of a very elongated rhombus of thin steel, having very near its center a concavity or cup, by means of which it can be belanced on a pivot. When it is thus balanced horizontally it does not, like an ordinary piece of matter, remain in equilibrium in all azimuths, but assumes one particular direction, to which it always comes back after displacement. In this position of equilibrium one of its ends points to magnetic north and the other to magnetic south, which differ in general by several degrees from geographical, or true, north or south. This is the principle on which compasses are constructed.

Mutual Action of Poles.—The two poles of a magnet appear identical when they are brought in contact with iron filings (see Fig. 2), but this identity is only apparent, for on presenting one end of a magnet to one end of a needle thus balanced, we obtain either repulsion or attraction, according as the pole which is presented is similar or dissimilar to that to which it is presented. When a small magnetic needle is suspended by a fine thread, and the north pole of another needle is brought near its north pole, repulsion takes place. If on the contrary, the pole is brought near the south pole of a movable needle, the latter is strongly attracted. Hence, these two poles are not identical, for one is repelled

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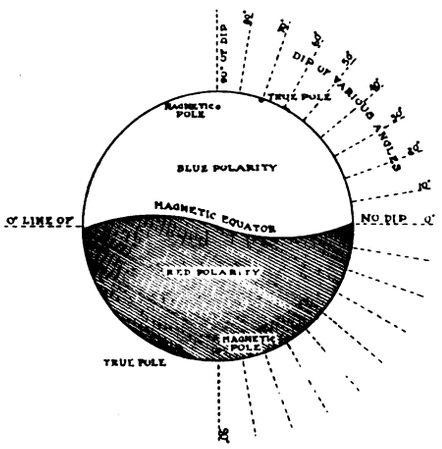
and the other attracted by the same pole of the magnet. It may be shown in the same manner, that the two poles of the latter are also different by successively presenting them to the pole (north) of the movable needle. In one case there is repulsion, in the other, attraction. Hence the first general law in magnetism is, that unlike poles attract one another and like poles repel one another; or poles of contrary names attract and poles of the same name repel.

Magnetic Force.—The force with

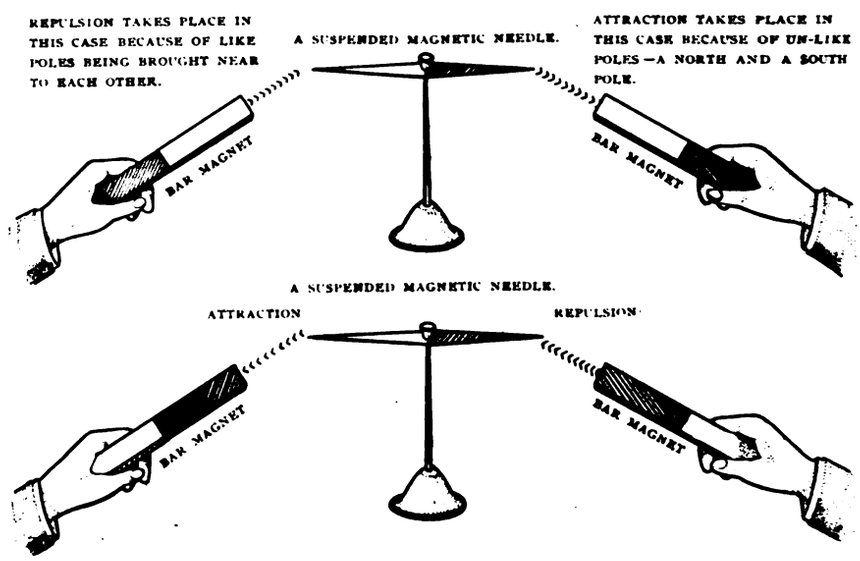


which a magnet attracts or repels another magnet, or any piece of iron or steel, is called magnetic force. The force exerted by a magnet upon a piece of iron or another magnet is not the same at all distances, the force being greater when the magnet is nearer, and less when the magnet is farther off. In fact, the attraction due to a magnet pole falls off inversely as the square of the distance from the pole.

Whenever a force acts thus between two bodies, it acts on both of them, tending to move both. A magnet will attract a piece of iron, and a piece of iron will attract a magnet. This may be shown by fixing a magnet on a piece of cork and floating it in a basin of water; it will be found to move across the basin when a piece of iron is held near. A compass needle thus floated turns round and points north; but it does not rush towards the north as a whole, nor towards the south. A piece of loadstone, or natural magnet, fixed upon a piece of cork and floated in a basin of water, represented Columbus' compass equipment on his trip across the trackless ocean.

Attraction Across Bodies.—Magnetic attraction and repulsion are exerted without modification through any body which may be interposed, provided it be not magnetic. Thus, a small cylinder of soft iron is readily attracted by a magnet through a plate of glass or piece of wood; and similarly, of course, the magnetic needle may be attracted. A magnet sealed up in a glass tube still acts as a magnet. A magnet put in a brass vase has been found to attract iron filings through the brass. Across water, vacuum, and all known substances, the magnetic forces will act.

Magnetic Induction.—When a piece of soft iron is in contact with a magnet, or even when a magnet is simply brought near it, it becomes itself, for the time, a magnet with two poles and a neutral portion between them. Thus if the north pole of a magnet be brought near to the end of a small bar of iron, that end becomes a south pole, while the remote end of the bar becomes a north pole. The opposite effect will take place when the south pole of the magnet is presented, and, in general, the magnetism induced in the bar is such that a


REPULSION TAKES PLACE IN THIS CASE BECAUSE OF LIKE POLES BEING BROUGHT NEAR TO EACH OTHER.
A SUSPENDED MAGNETIC NEEDLE.
ATTRACTION TAKES PLACE IN THIS CASE BECAUSE OF UN-LIKE POLES—A NORTH AND A SOUTH POLE.
BAR MAGNET
BAR MAGNET
A SUSPENDED MAGNETIC NEEDLE.
ATTRACTION
REPULSION
BAR MAGNET
BAR MAGNET

THE MAGNETS IN THIS DIAGRAM ARE PERMANENT MAGNETS.

A North Pole and a South Pole of two magnets attract each other, especially if one of the magnets be suspended. Two South Poles repel each other. A South Pole and a North Pole attract each other; two North Poles repel each other. A careful study of the above diagram will make this clear.

contrary pole is developed at the end next the inducing pole of the magnet, and a similar pole at the remote end. These facts may be shown by means of a compass needle. The end of the bar remote from the acting pole attracts one of the poles of the needle and repels the other in a manner precisely similar to the acting pole itself. The magnetism developed in the end of the bar next the acting pole is not so easily manifested, for the magnetic needle placed near that end will be acted on directly by the pole of the magnet itself, as well as by the induced pole of the iron bar, and the result will be complicated by the joint action.

The iron bar, thus rendered magnetic, exhibits all the properties of a magnet. It attracts iron, the attractive force increasing from the center of the two poles. If we scatter filings over the iron they will adhere to its ends, as in the case of the original magnet, the effect being only complicated by the action of the inducing pole. If we take away the influencing magnet the filings will fall off, and the iron will retain no traces at all, or very faint ones, of its magnetization.

But if the magnet is turned end for end, and the position of the poles changed, then the marked end (N. or red pole) of the magnet, will instantly induce in the ends of the soft iron poles of a character opposite to those they previously had, which may be easily tested by holding a suspended magnetic needle to the outermost ends of the soft iron, and the experiment is an illustration of the effect of transient induced magnetism.

Again, if we lay two magnets in a line at a short distance, with unlike poles turned to one another, and place a thin bar of soft iron between them, the latter becomes a temporary magnet while so situated; for the end next the red pole of the magnet will become an S. pole, and the end next the blue pole of the other magnet will become an N. pole. The iron bar has now become a magnet by induction.

But the effect is only temporary, for if we turn the iron bar gradually about its center, it will as gradually lose the magnetism acquired by induction; when it is at right angles to the two magnets it will be in a neutral condition, and if turned further it will become magnetized in the opposite way.

If a soft iron bar be presented endwise to either pole of a suspended magnet it will attract, though slightly, that pole; and it is indifferent which end of the iron bar is presented. In either case the pole of the magnet "induces" a pole of an opposite character. As before stated, there is always attraction.

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The power of inducing magnetism in iron diminishes as the distance increases. When the inducing magnet is slowly removed, the force exerted by the ends of the iron bar undergo a corresponding dimunition; and they cease to exist altogether when the magnet is wholly withdrawn, and the bar returns to its natural or neutral state. Thus the magnetism induced in iron is temporary only.

The foregoing facts enable us to account for the attraction of iron by the magnet, and to reduce the phenomeron to the general principle of the attraction of opposite, and the repulsion of similar poles.

When the pole of a magnet is brought near to a mass of iron, the immediate effect, we have seen, is to render the latter a magnet by induction, an opposite magnetism being developed in part of the mass which is nearest to the acting pole, and a similar magnetism in the part which is most remote. Now, as opposite poles attract one another, while similar poles repel, attraction will ensue between the acting pole and the nearer parts of the iron mass, and the repulsion between the same pole and the remoter parts; and the former of these forces will preponderate, being exerted at a shorter distance. It follows from this that attraction must always result, whichever pole of the magnet be presented to the iron.

Since the magnetism which has been induced in a piece of iron imparts a similar condition to a second piece in its vicinity, and that to a third, and so on, it follows that attraction must ensue between these several pieces, although with diminishing energy, as they are more distant from the acting pole; and the first will support a second, a second a third, and so on, if only the weights of the successive pieces be proportionate to the diminished force. A magnetic chain can thus be formed, having two poles. The following experiment illustrates the matter: Let a few pieces of iron rod, or a few soft iron nails be taken. If one of these be placed in contact with the pole of a permanent steel magnet, it is attracted to it and becomes a temporary magnet; it now, in turn, supports a second piece; this, in turn, a third piece, and so on, until a chain of four or five pieces is built up. Each of these pieces of iron is itself a magnet. If it be the north pole of the magnet to which the pieces are attached, the end on the first piece in contact with the steel magnet will have south, and the other end north, magnetism, and this last will develop in the nearest end of the next piece of iron, south magnetism, and so on. But if the steel magnet be removed from the top of the chain, all the rest drop off and are found to be no longer magnetic. A piece of soft iron laid with one end on the end of a magnet practically becomes part of the magnet, simply extending its length, and its further end being of the same polarity as that of the magnet to which it is joined.

POLARITY.

The influence that gives directive force to the compass needle, causing it to point to the magnetic north, is called polarity. It is customary to regard the polarity which exists in the north end of the compass needle, red polarity, whence it follows that south, blue polarity, must pervade the regions of the terrestrial north, because it is a law of nature that bodies similarly magnetized will repel, while those dissimilarly magnetized will attract each other.

SOFT IRON.

As regards magnetism, it is iron which becomes instantly magnetized to its full capacity, when exposed to the influence of any magnetized body, and which loses its magnetism instantly when the influencing body is removed. Now the earth may be regarded as a huge magnet having the same properties as the natural and artificial magnet and possessing the two poles (north and south polarities), and a neutral line, or magnetic equator. The north magnetic pole of the earth's magnetism was situated, at the time of discovery, in Boothia Felix, to the NNW, of Hudson bay, in British North America, and has actually been reached by man, it being discovered by Sir James Ross, of the English navy, on June 1, 1831; while the other, lies to the south of Tasmania, but owing to impenetrable barriers of ice, has not been quite reached, but so nearly that its position was without difficulty ascertained by calculation. The magnetic poles of the earth are entirely distinct from its poles of rotation, and too, they are not diametrically opposite each other as the true poles of the earth; the north magnetic pole being situated about 1,200 nautical miles south of the true or geographical pole of the earth, and the south magnetic pole about 900 nautical miles north of the true south pole.

Like other magnetic bodies, the two terminal portions of the earth's magnetism are its poles, where the attraction is greatest. Unlike the true, or geographical poles, which are represented by a mere point, the magnetic poles include a considerable area of the earth's surface, amounting perhaps to fifty square miles. These magnetic poles are not permanent fixtures, but instead they shift slowly from west to east and back again after long periods of time, but for what reason no one knows, it being due to some unknown law.

The True or Geographical Poles are the extremities of the earth's axis, the two points of 90° north and south from the equator; or where all the meridians of longitude cross or cut one another, or the points where there is no longitude at all or 360° of it, just as you please. These are also the points where there is only one direction; being situated on the true north pole of the earth, you could only look or go in one direction, namely, south, therefore, the direction south must commence at the true north pole of the earth. The conditions would be identical to an observer situated on the true south pole of the earth, except the one direction there, being north; therefore, the direction north must commence at the true south pole of the earth. An observer situated at either of these two points during the summer season of each, would always have the sun on the meridian, bearing either due north or due south, but if he should take one step from the pole, the above conditions would instantly change, for he would then have all the directions of the compass, and the sun would change its bearing readings, the same as other positions on the earth's surface. The reader of this will probably wonder where the directions east and west commence. These directions, as well as all others, with the exceptions of north and south, have no commencing point; they can start from anywhere.

MAGNETIC EQUATOR OF THE EARTH.

Now, as the earth has two magnetic poles, it must also have a magnetic equator. This magnetic equator is a sinuous curve encircling the earth, and crosses the geographical equator in two places nearly diametrically opposite to each other, something after the fashion of the ecliptic. The magnetic equator crosses the earth's equator on the eastern side of the Atlantic, at about the meridian of 11° west, and the other in the Pacific, about longitude 168° west. Its greatest divergence from the true, or earth's equator, is in Brazil. Now, the earth's magnetic equator, acts the same as the equator does of any other magnet. It separates the two polarities of the earth's magnetism from each other. It is a neutral line where there is no vertical force issuing forth. This means that at any place on this line on the earth's surface, the dipping needle (to be explained later) rests in a horizontal position.

D. C. Stover & Co., Freeport, Ill., have undertaken the manufacture of marine engines.

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A USEFUL TOOL.

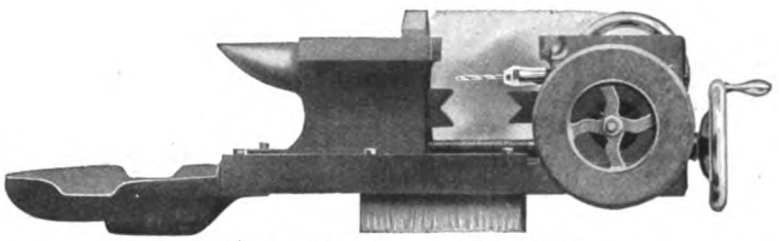
The Detroit Tool Co., of Detroit, Mich., are manufacturing the Detroit combination tool, picture of which is here shown. This is the neatest, most compact and handiest all 'round tool ever devised for use on vessels of every description. In the engine room of the big steamboat, on the yacht and naphtha launch where the matter of space is of such vital importance, this tool will be greatly appreciated, as it combines in one tool a forge, with rotary blower, anvil, vise, pipe vise, geared drill and emery wheel. Every feature of the tool is practical.

In detail the tool consists of an iron base, having at one end a stationary head stock, at the other, a movable anvil and overhanging forge hearth. The head stock contains the mechanism of the rotary blower, drill and emery wheel, and forms the stationary part of the vise and pipe vise jaw. The anvil serves as the movable part of the vise and pipe vise jaw and moves back and forward on the bed piece between two adjustable guides, and is operated through a screw by a hand wheel at the outer end of the head stock. The air delivered by the blower in the head stock is conveyed through a cored channel in the bed piece to the forge hearth at the opposite end. The forge hearth is attached to the bed piece by means of interlocking lugs and can be removed and replaced in an instant. This is of great value to the engineer or yachtsman, as it enables him to remove the forge hearth and set it aside when not in use, thus taking up very much less space. The fan shaft of the blower projects through the air intake at the side of the gear case, and is fitted to receive an emery wheel. The emery wheel is constructed with an open center in such a way as to force the air into the intake pipe and in so doing it draws the emery dust away from the operator and into the forge. The blower and emery wheel are operated by a hand crank, located on the rear side of the gear case. This crank is fitted with a pulley for the application of power when so desired. The fan and emery wheel are geared 12 to 1 and may be run by hand, 2,000 revolutions per minute. The drill is operated by the same driving wheel and is fitted with a clutch arrangement so that it may be thrown in and out of gear at the will of the operator and either the drill or blower may be operated independently of each other.

The tool is made of high grade material, beautifully finished, all working parts are machined, is equipped with cut gears and will be an ornament to any boat or yacht.

The accessories furnished with the tool include drill, a blacksmith's hardy, blacksmith's tongs, and a crucible holder for holding a crucible or metal ladle over the fire.

The tool is made in three sizes, ranging in price from $25 to $50.



A HANDY TOOL FOR USE ON BOARD SHIP.

EFFICIENCY OF SUBMARINE SOUND SIGNALS.

The Submarine Signal Co., 88 Broad St., Boston, Mass., has received the following letter from Capt. R. Saurmann of the Hamburg-American liner Amerika concerning the efficiency of submarine sound signals, showing the superiority of the submarine bell over the ordinary form of whistle from light vessels:

"Dear Sirs,—I consider the Submarine Signal as a most valuable assistance for navigating a vessel in foggy weather. As an example I state the following fact: Approaching Nantucket light vessel on a west course in a dense fog with a light S. S. E. breeze and smooth sea on May 5, 1906, we heard the Submarine Signal very slightly on our port side in a distance say about 4-6 miles. When the sound ceased at 0.10 p. m., I put the vessel on a south course and heard the signal then again till 0.45 p. m. I was then sure that I had the light vessel to the eastward and put my course direct for Fire Island light vessel. During all the time we never heard a single sound of the Nantucket light vessel's steam whistle.

Yours very truly,
(Signed) CAPT. R. SAURMANN,
S. S. Amerika.

CANADIAN SHIPPING NOTES.

The dredge Galveston which reached Quebec July 1 was built in Great Britain for harbor work at Galveston, Texas, was found to be too large for work and was bought by the Dominion government. The Galveston is a dredge of the sand pump type and is 233 ft. long, 39 ft. broad, and 15 ft. 5 in. deep.

The department of public works of the Dominion government will build three 500-yd. steel hopper scows on Georgian bay. They will be of modern design and will be 144 ft. long, 30½ ft. beam and 11½ ft. deep.

The underwriters have paid total loss claims upon the Allan line steamer Bavaria which went ashore on Wye rock near Quebec in the fall of 1905. Representatives of the wrecking firms have not altogether abandoned, however, the hope of salving the steamer.

The Allan Steamship Co. has placed an order with Barclay, Curle & Co., on the Clyde, Scotland, for a passenger cargo steamer to be 500 ft. long, 60 ft. beam and 41 ft. deep, and to be equipped with triple-expansion engines.

The department of marine of the Dominion government has placed an order with the dock yard at Sorel, Quebec, for the construction of a spoon dredge for work on the St. Lawrence ship canal at Cap a la Roache.

The success of the Pacific Steam Whaling Co., of Victoria, British Columbia, in the whaling industry, has attracted the attention of local and Puget sound capitalists with the result that a company has been recently formed to engage in the business. The agents in San Francisco for the company are the Barneson-Hibbard Co., the shipping merchants. The new whaling corporation will have a station in southeastern Alaska, and a new steamer is to be constructed at once which will probably be of steel. The Pacific Steam Whaling Co. has been actively engaged in the business for about a year, and it has now reached such proportions that another steam tender is to be built to assist the steamer Orion, which was brought to Victoria from the Atlantic. The company has a station at Sechart, but before next spring it will establish another at Nootka sound. It is not the sperm or right whale that this new industry demands, but, the common "gray back" that is found in great numbers off the north Pacific coast. This whale is hunted down and towed to the station, where every part of the animal is utilized. The industry is one of the most important in Norway, and it is stated that the new company will import efficient men from that country to carry on the work.

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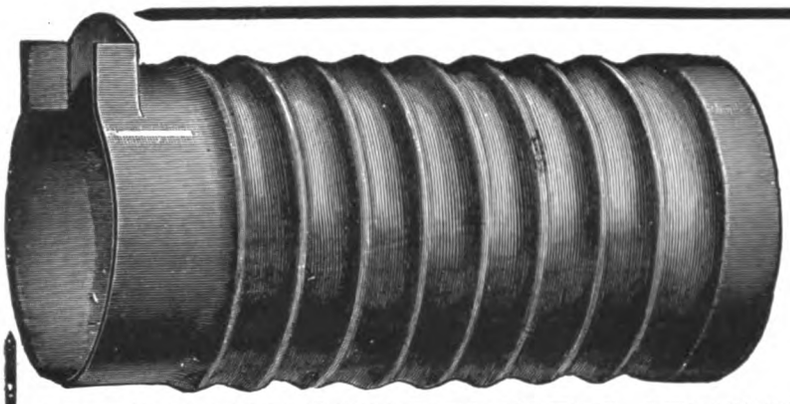

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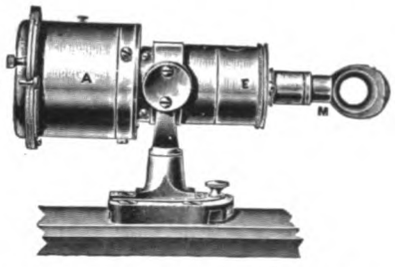

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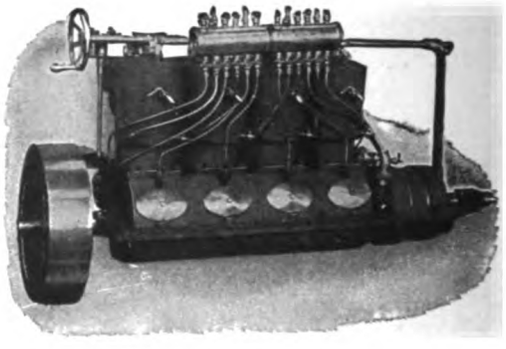

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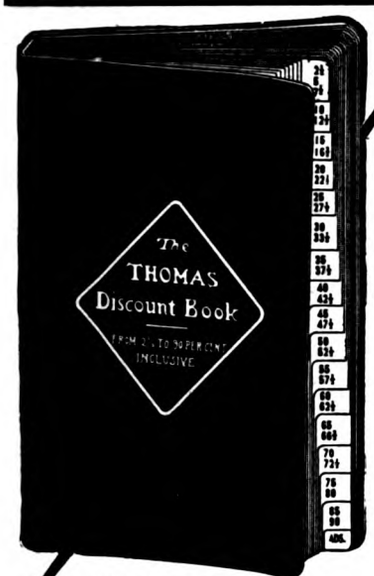

Edited and compiled by MILLARD T. THOMAS.

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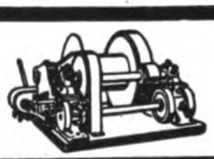

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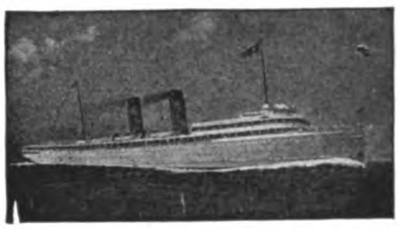

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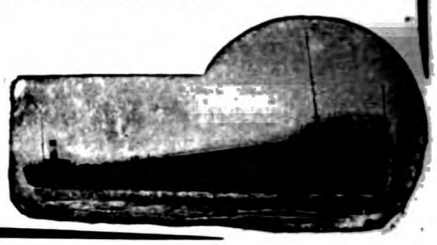

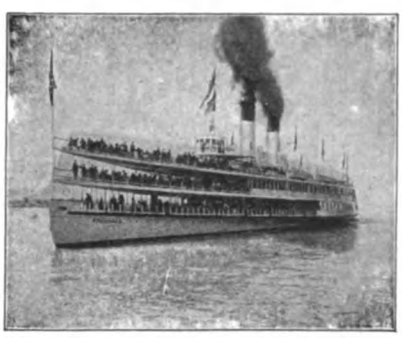

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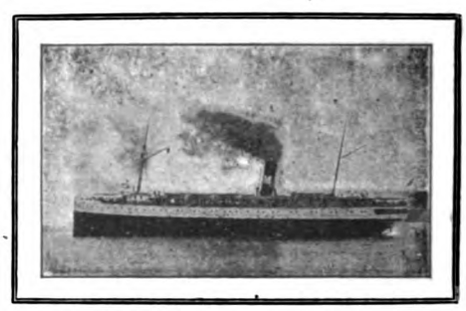

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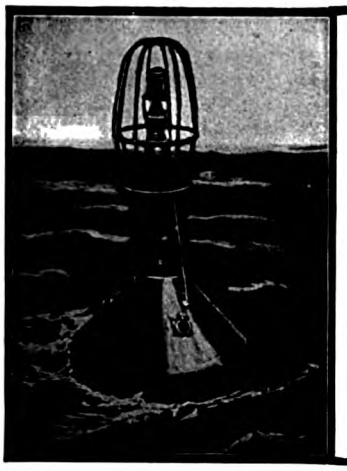

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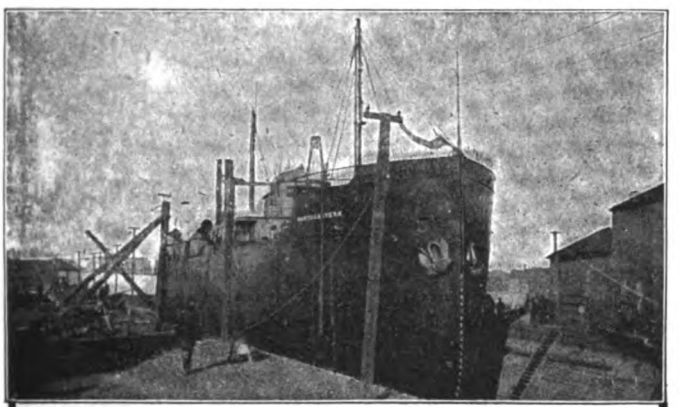

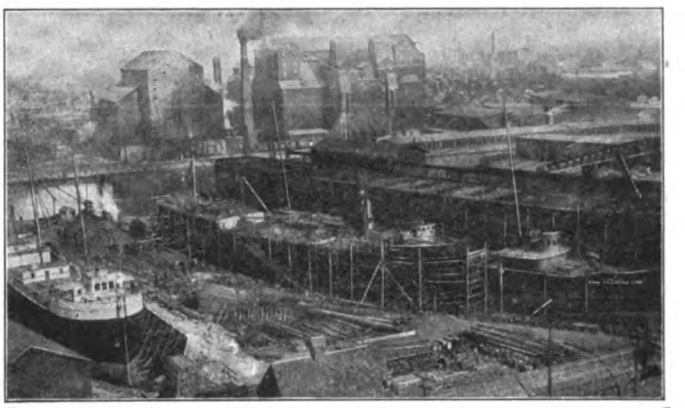

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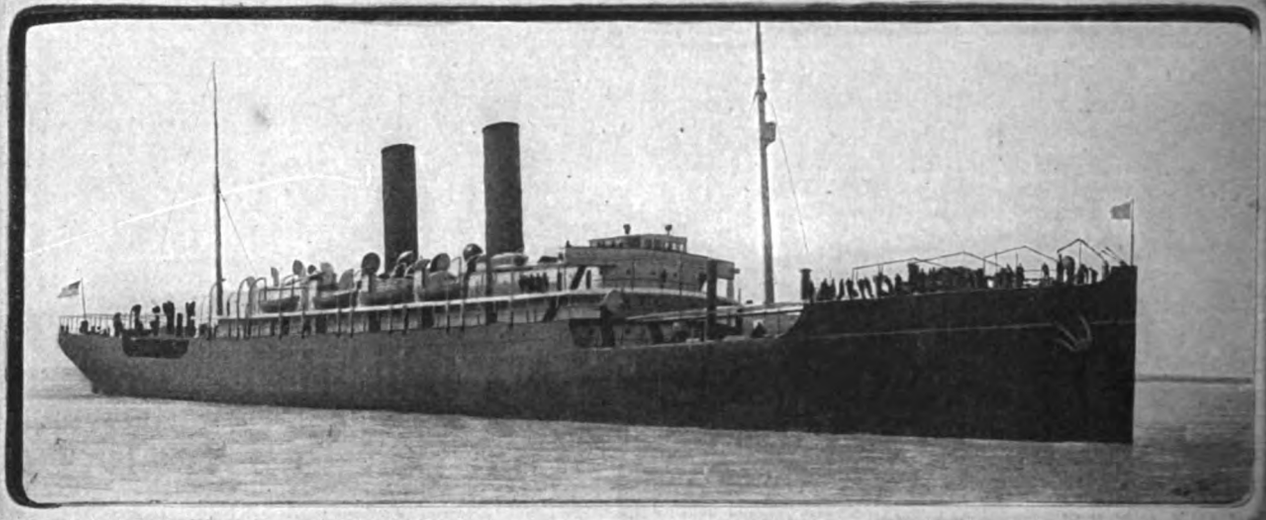

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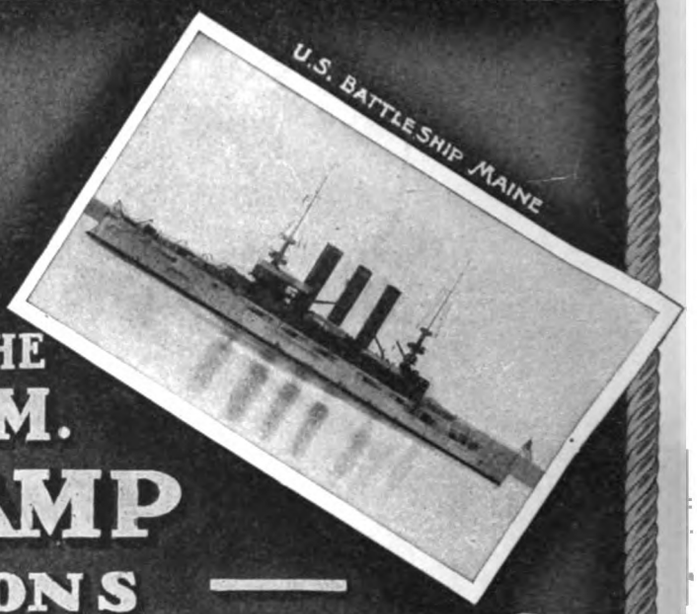

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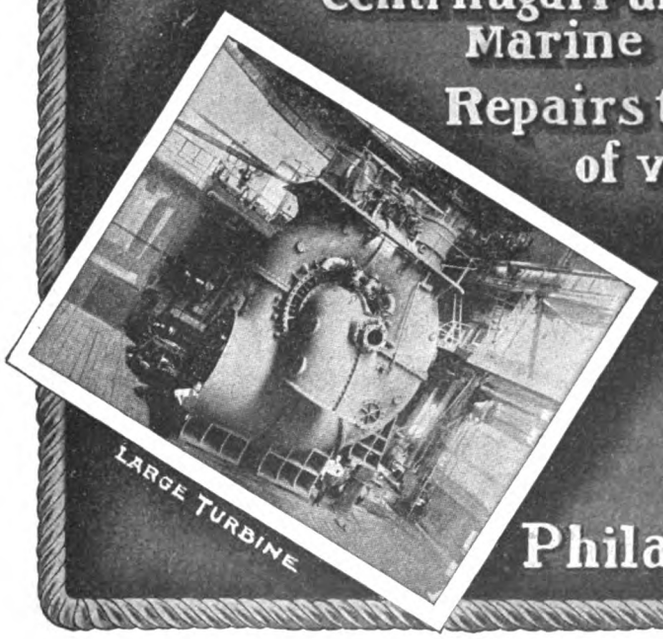

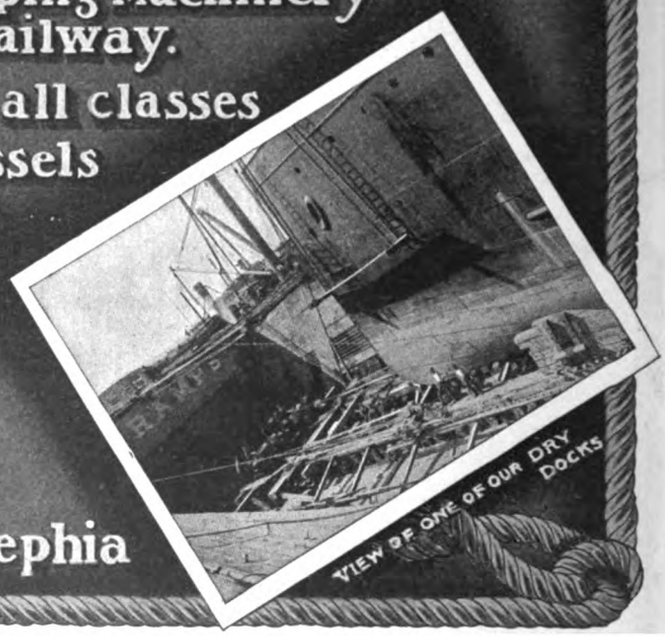

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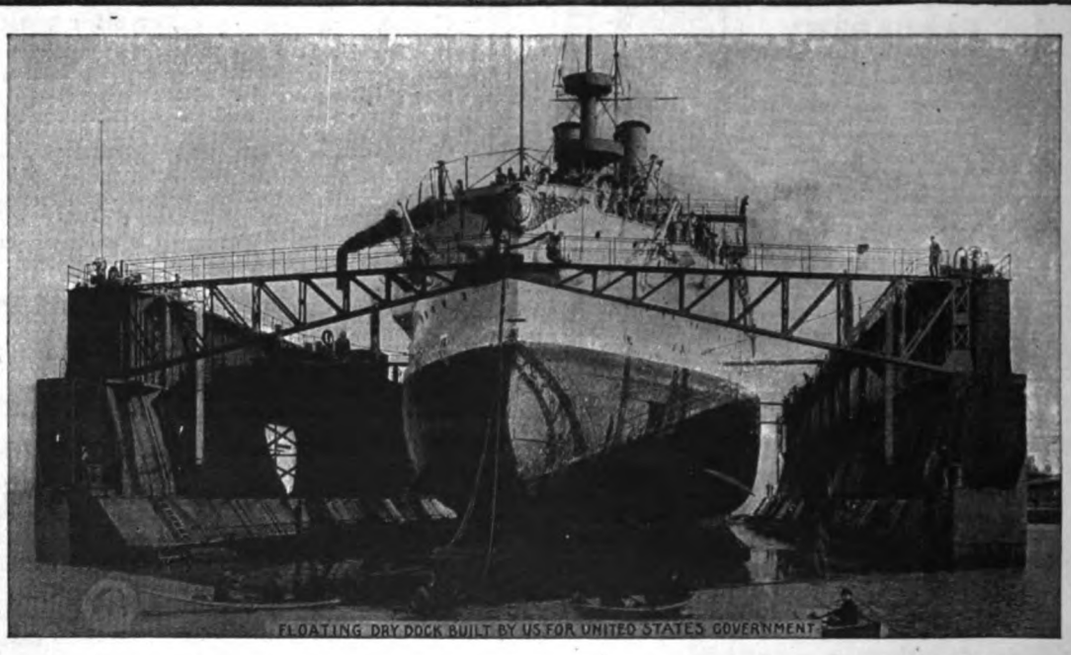

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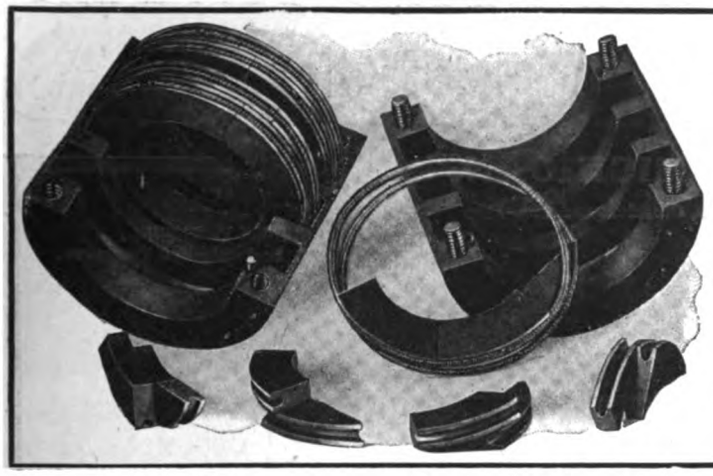

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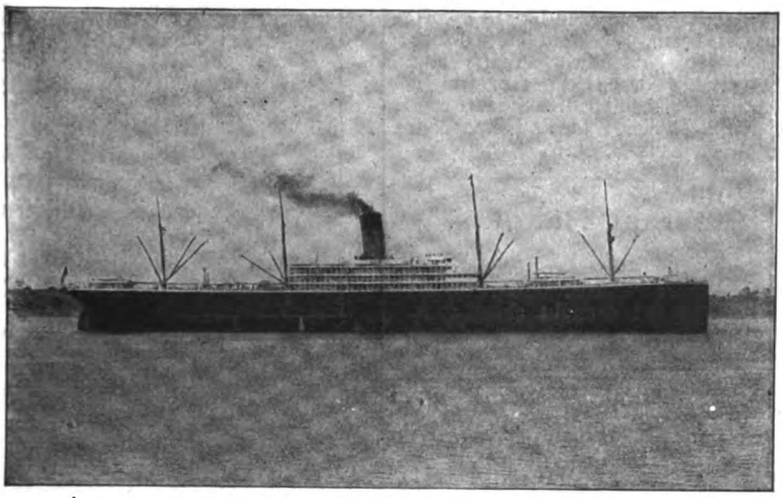

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U. S. Engineer Office, Jones Building, Detroit, Mich., Aug. 2, 1906. Sealed proposals for dredging Shoal 28 in Mud Lake, St. Marys River, Mich., will be received at this office until 2 p. m., Aug. 17, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col., Engineers.

Sealed proposals, in duplicate, endorsed "Proposals for Coal-Handling Plant, U. S. Naval Coal Depot, California City Point, Cal.," will be received at the Bureau of Equipment, Navy Department, Washington, D. C., until 11 o'clock a. m., October 3, 1906, and then and there publicly opened, for furnishing and erecting in complete working order a coal-handling plant. Plans and specifications may be obtained on application to the Bureau of Equipment. WM. S. COWLES, Chief of Bureau, July 28, 1906.

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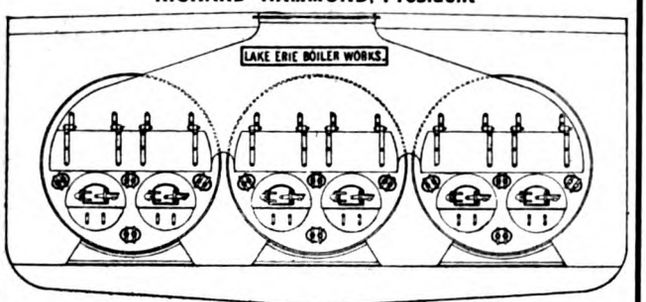
RICHARD HAMMOND, President



THE BEST EQUIPPED PLANT IN AMERICA FOR THE MANUFACTURE OF MODERN MARINE BOILERS BUFFALO, N.Y.

New Fast Train to Columbus
THE COLUMBUS FLYER
Via
BIG FOUR ROUTE

Leaves Union Station 6:15 p. m., daily except Sunday, with combination Baggage and Smoking Car, highback coaches and Pullman Buffet Parlor Cars (serving light supper en-route), Stopping at Wellington, New London, Shelby, Crestline, Galion and Delaware and arrives at Columbus 9:35 p. m. Get tickets and Pullman seats at Big 4 Ticket office, No. 532 Euclid Avenue or Union Depot.

THIS IS A VERY FAST TRAIN Try It

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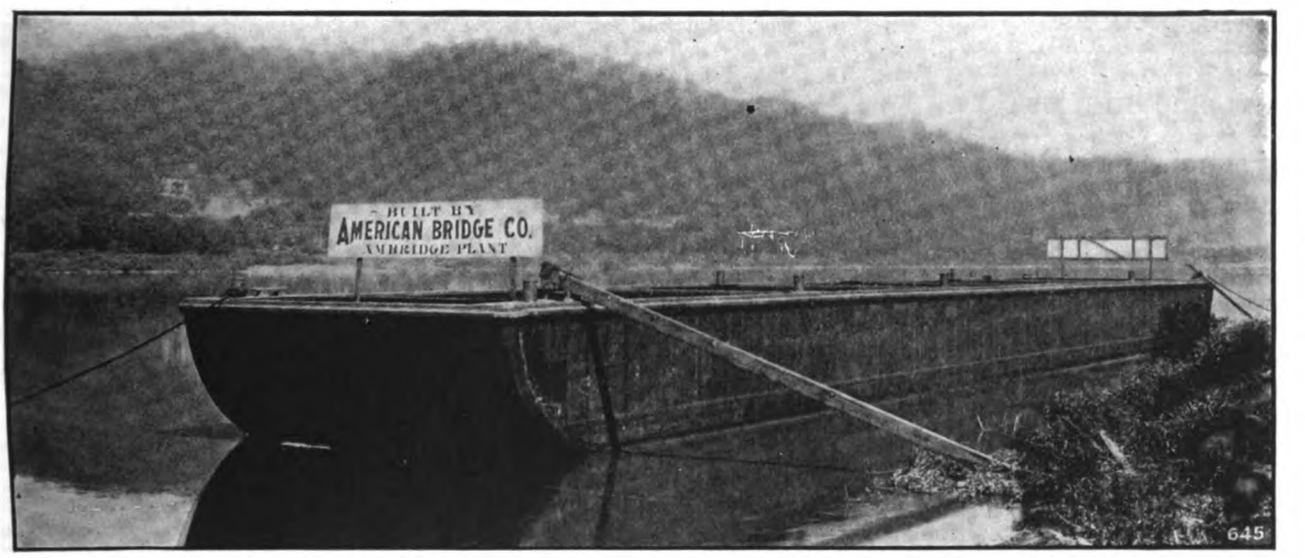

We have on hand at Ambridge, Pa., for immediate delivery, one steel barge of which the following is a general description:

Length over all	-	**173′ 0″**
Breadth (Moulded)	-	**26′ 0″**
**Depth " **	-	**10′ 0″**

The barge is of the open hold type with a twelve-in. (12″) deck side stringer forming a gangway at each side. The bilge or knuckle of this barge is rounded off to a radius of 12″, this construction being carried up rake to deck. The ends in elevation are rounded off forming rake of about 10′ 0″ radius. At each end at foot of rake, a steel, watertight collision bulkhead is fitted, forming with the rake framing a substantial construction for towing purposes. Heavy cross beams are fitted about 30′ 0″ apart and at tow posts. The ordinary transverse framing is spaced about 2′ 0″ apart and deep floors and web frames are arranged about 15′ 0″ apart and at tow posts.

At the ends, a working deck is fitted and an ample number of towing posts are provided for the proper handling of the barge. A rubbing strake is fitted on the side and ends of this barge and two pump casings or boxes are provided. This barge is well adapted for carrying bulk cargoes such as coal, etc., but it should be noted that there is no wood ceiling laid on floors. The carrying capacity in short tons on a fresh water basis is as follows:

At 8′ 0″ draft	-	**970 tons.**
At 6′ 0″ draft	-	**700 "**

For price and further particulars apply to the

American Bridge Co. of New York

FRICK BUILDING

PITTSBURG, PA.

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BUYERS' DIRECTORY OF THE MARINE TRADE.

For a more complete classification than that represented by advertisers in The Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, Marine and Naval Directory of the United States, published by The Marine Review, Cleveland.

[See accompanying Index of Advertisers for full addresses of concerns in this Directory.]

AIR COMPRESSION, HOISTS.
Great Lakes Engineering Works....Detroit.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.....New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.

ANCHORS.
Bowers, L. M. & Co.....Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co....Detroit.
Great Lakes Engineering Works....Detroit.

ASH EJECTORS.
Great Lakes Engineering Works....Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley....Cleveland.
Jenkins, Russell & Eichelberger....Cleveland.
Kremer, C. E. .....Chicago.
MacDonald, Ray G.....Chicago.
Shaw, Warren, Cady & Oakes.....Detroit.
White, Johnson, McCaslin & Cannon.....Cleveland.

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.....Brookline, Mass.

BELTING (LEATHER.)
Republic Belting & Supply Co.....Cleveland.

BLOCKS, SHEAVES, ETC.
Boston Lockport Block Co.....Boston, Mass.

BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, David.....New York.
Marine Construction & D. D. Co....Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

BOILER COMPOUNDS.
The Bird-Archer Co.....New York
Dearborn Drug & Chemical Works.....Chicago.
Lake Erie Boiler Compound Co.....Buffalo
State Manufacturing Co...Cleveland.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co.....Providence, R. I.

BOILER MANUFACTURERS—Continued.
American Ship Building Co.....Cleveland.
Atlantic Works..East Boston, Mass.
Chicago Ship Building Co..Chicago.
Cramp, Wm. & Sons..Philadelphia.
Dearing Water Tube Boiler Co.....Detroit.
Detroit Ship Building Co....Detroit.
East End Boiler Works....Detroit.
Fletcher, W. A. & Co.....Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.
Kingston Foundry & Machine Works .....Oswego, N. Y.
Maryland Steel Co.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher Water Tube Co..New York.
Newport News Ship Building Co..Newport News, Va.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co.....Duluth, Minn.
Quintard Iron Works Co.....New York.
Roberts Safety Water Tube Boiler Co. .....New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co....Detroit.
Toledo Ship Building Co.....Toledo.

BOILER RIVETS.
Bourne-Fuller Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons....Philidelphia.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works..Detroit.
Lunkenheimer Co.....Cincinnati.

BRIDGES, BUILDERS OF.
Scherzer Rolling Lift Bridge Co....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co.....Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.....Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.....Buffalo.
Bunker, E. A.....New York.
Upson-Walton Co.....Cleveland.
Republic Belting & Supply Co....Cleveland.

CAPSTANS.
American Ship Windlass Co.....Providence, R. I.
Dake Engine Co.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.....Jersey City, N. J.

CHAIN SURVEYORS, HOISTS.
Brown-Hoisting Machinery Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co.....Boston, Mass.
Republic Belting & Supply Co.....Cleveland, O.

CHARTS.
Penton Publishing Co....Cleveland

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co....Cleveland.
Pittsburg Coal Co.....Cleveland

COAL AND ORE HANDLING MACHINERY.
Brown-Hoisting Machinery Co.....Cleveland.

COMPASSES.
Ritchie, E. S. & Son.....Brookline, Mass.

CONDENSERS.
Great Lakes Engineering Works....Detroit.
Thropp & Sons Co., John E.....Trenton, N. J.
Wheeler Condenser & Engineering Co.....New York.

CONTRACTORS FOR PUBLIC WORKS.
Breymann Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Great Lakes Dredge & Dock Co....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H.....Milwaukee.
Standard Contracting Co..Cleveland.
Sullivan, M.....Detroit

CORDAGE.
Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

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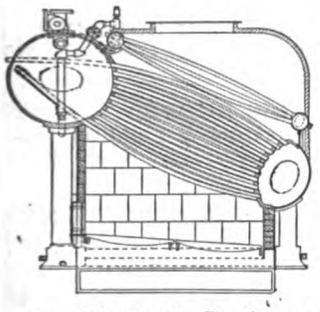
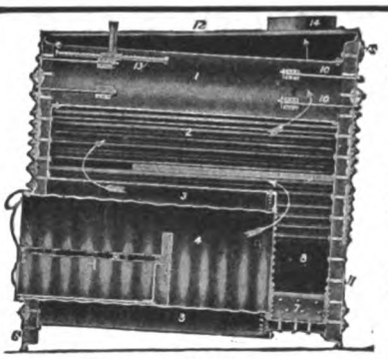
THE MOSHER PATENT WATERTUBE BOILER



Simplest, lightest most compact boiler made. Most accessible for cleaning and repair. Five vertical rows or as many as 45 tubes may be cleaned or withdrawn by removing the cover from a single hand hole. Largest grate surface on a given floor space. No joints in the fire. All joints expanded. Greater steam room and water capacity than any other boiler. Built in sizes up to 2000 H. P. Mosher Boilers have been supplied for eleven torpedo boats and the monitor Florida of the U. S. Navy, amounting to over 26,000 H. P., six torpedo boats for the Russian Navy two gun boats for the Mexican government, one cruiser and one torpedo boat for the Brazilian government; the steam yachts Arrow, Elide, Feiseen, Wauneta, Presto, and numerous other yachts and vessels.

SEND FOR DESCRIPTIVE CATALOGUE.

MOSHER WATERTUBE BOILER CO., No. 1 Broadway, N. Y.



Detroit Scotch Water Tube Boiler

Internally Fired.

Scotch and Water Tube types combined, eliminating all objections.

Half the weight of ordinary Scotch boilers.

Standard corrugated furnaces.

Patent applied for. Investigate before buying any other.

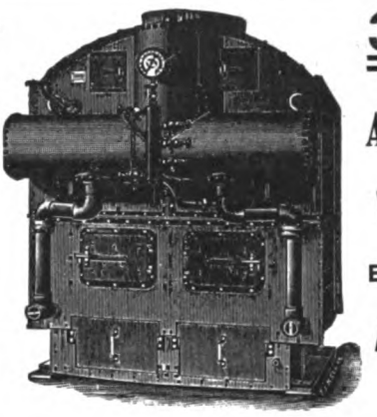
EAST END BOILER WORKS
Detroit, Mich.

Taylor Water Tube Boiler Co.

Vertical Tubes, sectional, large steam space and liberating area.
Fire box, combustion chamber, and course for the furnace gases similar to the Scotch Marine.
Free circulation type.

Send for full description.

322 Franklin St.
DETROIT, MICH.



350 STEAM VESSELS

Now Equipped With

ALMY'S PATENT SECTIONAL Water Tube Boilers

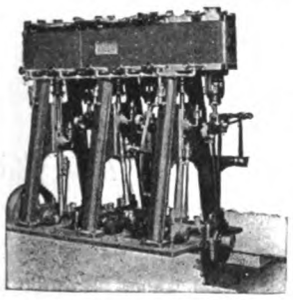
Bear Evidence of Their

Excellent Qualities

ALMY WATER-TUBE BOILER CO.
PROVIDENCE, R. I.

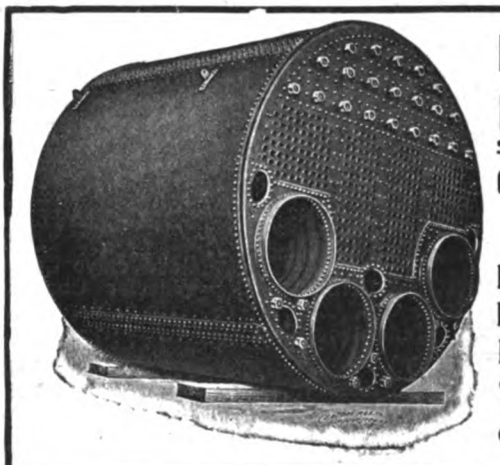
John E. Thropp & Sons Co.

TRENTON, N. J.



Builders of Single, Compound, Triple-Expansion and Direct Connected Engines.

Boyer Sectional Water Tube boilers and Machinery complete for light draft Passenger Boats, Yachts, Tugs, Etc.



MARINE BOILERS

OF ALL TYPES

KINGSFORD FOUNDRY & MACHINE WORKS,
Oswego, N. Y.

LATEST PATENT ANCHOR

THE NATIONAL

APPROVED BY LLOYDS.

Manufactured by

L. M. BOWERS & CO.,

Binghamton, N. Y

Catalogue on Application.

The National and International

ANCHORS.

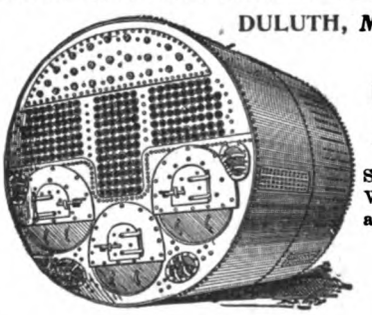
Furnished to the Lake Trade by

The Upson-Walton Co.,

CLEVELAND, O.

Northwestern Steam Boiler & Mfg. Co.

DULUTH, MINN.



Manufacturers of

BOILERS, ENGINES AND MACHINERY

Special facilities for Marine Work. Repairs promptly attended to Night or Day.

We carry a complete line of Marine and Engineers' Supplies.

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RESIDENCE CALLS: M. A. RYAN, *Pres. and Gen'l Mgr.*, 776-R.
J. H. OPPERMAN, *Secretary*, 579-R; E. KRIZ, *Superintendent*, 557-M.

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CORK JACKETS AND RINGS.
Armstrong Cork Co..Pittsburg, Pa.
Kahnweiler's Sons, D....New York.

CRANES, TRAVELING.
Brown-Hoisting Machinery Co.....
.... Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....
.... Buffalo.
Great Lakes Dredge & Dock Co..
.... Chicago.
Hickler Bros. .....
.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M..... Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.New York.

DRY DOCKS.
American Ship Building Co.....
.... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....
.... Chicago.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co.....
.... Detroit
Great Lakes Engineering Works....
.... Detroit.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
....Milwaukee.
Newport News Ship Building Co...
.....Newport News, Va.
Shipowners' Dry Dock Co.Chicago.
Superior Ship Building Co.....
.... Superior, Wis.
Tietjen & Lang Dry Dock Co.....
..... Hoboken, N. J.
Toledo Ship Building Co.....Toledo.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....
..... Manitowoc, Wis.

DYNAMOS.
General Electric Co.....
....Schenectady, N. Y.
Thropp & Sons, John E.....
....Trenton, N. J.

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General Electric Co.....
.....Schenectady, N. Y.

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co.....
.....Schenectady, N. Y.
Thropp & Sons, John E.....
.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co.....
..... Cleveland.
Atlantic Works, East Boston, Mass.
Chicago Ship Building Co., Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons, Philadelphia.
Detroit Ship Building Co., Detroit.
Fletcher, W. & A. Co., Hoboken, N. J.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

ENGINE BUILDERS—Continued.
Great Lakes Engineering Works....
..... Detroit, Mich.
Hall Bros. ..... Philadelphia.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Maryland Steel Co.....
.....Sparrows Point, Md.
Milwaukee Dry Dock Co., Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co....
.....Newport News, Va.
New York Ship Building Co.....
.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Mich.
Quintard Iron Works Co., New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....
..... Superior, Wis.
Thropp, J. E. & Sons Co.....
.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co., New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. ..... Cincinnati.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander ..... Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James ..... Cleveland.
Roelker, H. B.....New York.
Wood, W. J.....Chicago.

FEED WATER PURIFIERS AND HEATERS.
Ross Valve Co.....Troy, N. Y.
Wheeler Condenser & Engineering Co. ..... New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co....
..... Cleveland.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

FLUE WELDING.
Fix's S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co., Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co.. Detroit.
Toledo Fuel Company, ...Toledo, O.

FURNACES FOR BOILERS.
Continental Iron Works, New York

GAS BUOYS.
Safety Car Heating & Lighting Co..
..... New York

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. ..... Cincinnati.

GAUGES, WATER.
Lunkenheimer Co.....Cincinnati, O.

GENERATING SETS.
General Electric Co.....
.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland

HOISTS FOR CARGO, ETC.
American Ship Building Co.....
..... Cleveland.
Brown-Hoisting Machinery Co.....
..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
General Electric Co.....New York.
Hyde Windlass Co.....Bath, Me.
Marine Iron Co.....Bay City.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co.....
.....Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works....
.... Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.....
..... New York

ICE MACHINERY.
Great Lakes Engineering Works....
..... Detroit.
Roelker, H. B.....New York.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros.....New York.
Lunkenheimer Co. ..... Cincinnati.
Penberthy Injector Co.....
..... Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A., Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F.....
.....New York and Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

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G. H. Breymann & Bro's

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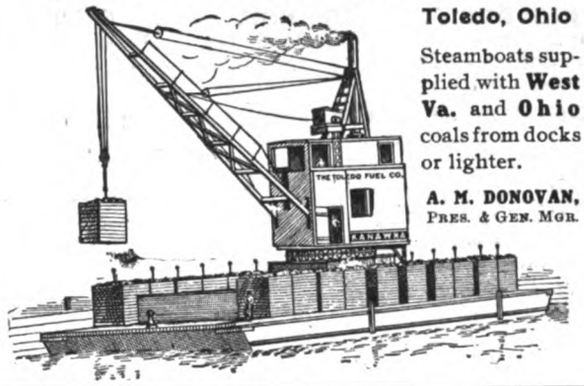
Dredging, Dock Building, Etc.

5, 6 AND 7 MARINE BUILDING
TOLEDO, OHIO.

The Toledo Fuel Co.



Toledo, Ohio

Steamboats supplied with **West Va.** and **Ohio** coals from docks or lighter.

A. M. DONOVAN,
PRES. & GEN. MGR.

Buffalo Dredging Co.

GENERAL CONTRACTORS
—ON—
SUBMARINE WORK

Office
D. S. Morgan Bldg.

BUFFALO, N. Y.

Hickler Brothers

SAULT STE. MARIE, MICH.

MARINE RAILWAY

Capacity, 1,000 tons. Draft, 7½ ft. forward, 13½ ft. aft. Length on keel blocks, 180 ft.; over all, 190 ft.

Machine Shop, Foundry and Steam Forge, Dredges, Drill Boats and Derrick Scows.

DUNBAR & SULLIVAN DREDGING CO.
BUFFALO, N. Y.

Ready for Spring — A New Tool

A REVOLVING CLAMSHELL DREDGE

which will do the following impossibilities to the ordinary dredge:

Excavate 60′ back from face of dock into scow or vice versa. Excavate at either end of itself and dump in scow at other end. This makes through cutting and cleaning narrow slips cheaply possible. Excavate trenches to 150′ or more depth. Excavate material and throw it one side 150′ from original site where there is four feet of water between dump and channel. Excavate shallow channels down to 4′ x 44′. Clean out boulders or obstructions without disturbing surrounding bottom. Excavate close to docks without injury to dock. Anything that ordinary derrick will do up to 10 tons at 75′ radius.

This is an excellent wrecking tool.

H. W. HUBBELL CO.

Submarine Work of all kinds

Dredging Hard Material a Specialty.

SAGINAW - - MICH.

M. SULLIVAN,

DREDGING OF ALL KINDS.

THE REMOVING OF DEEP WATER EARTH AND ROCK A SPECIALTY. - - -

53 Woodward Ave. Terrace,
DETROIT, - - - MICH.

Steamboat Fuel at Ashtabula.

Large Supplies of Best Quality.

Lighter Carrying Different Grades at all Times.

Fuel Scow with elevators and discharging spouts. Storage of 800 tons. Discharges 250 tons an hour into steamers while unloading cargo.

***M. A. Hanna & Co.,* Miners and Shippers,**
Main Office, Perry-Payne Bldg., Cleveland.

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Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....
.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong Cork Co.....Pittsburg.
Carley Life Float Co.....
.....New York, N. Y.
Drein, Thos. & Son.....
..... Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson.....Buffalo.

LOGS.
Nicholson Ship Log Co., Cleveland.
Walker & Sons, Thomas.....
..... Birmingham, Eng.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ..... Cincinnati.

LUMBER.
Martin-Barriss Co. ..... Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros., Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....
.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc....Philadelphia.

MARINE RAILWAYS.
Hickler Bros., Sault Ste. Marie, Mich.

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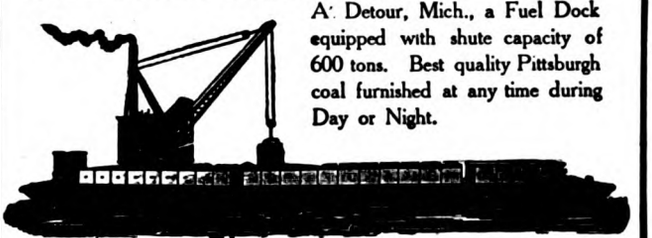

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Submarine Signal Co.....Boston

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Anchor Line .....Buffalo.
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....New York.
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Morse & Son, A. J.....Boston.
Schrader's Son, Inc. A....New York.

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Steel, Adam .....Cleveland.
Wood, W. J.....Chicago.

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Lunkenheimer Co....Cincinnati, O.

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Ross Valve Co.....Troy, N. Y.

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Hutchinson & Co.....Cleveland.
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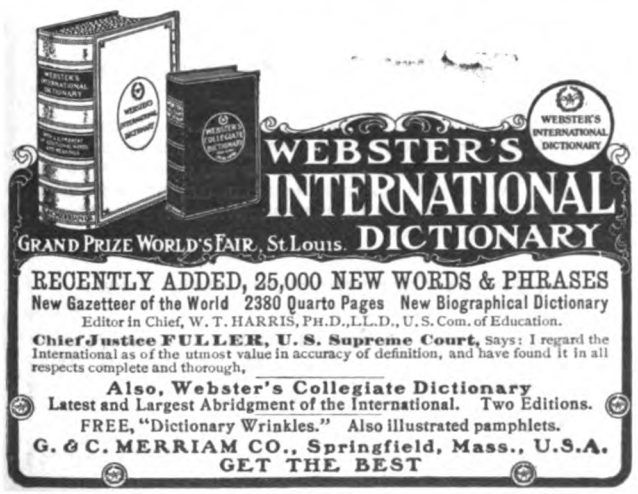
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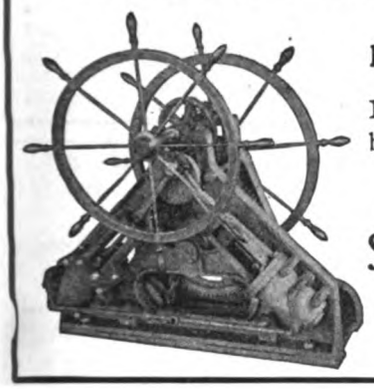

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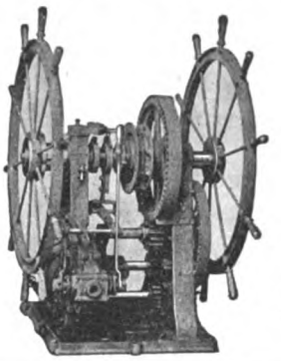

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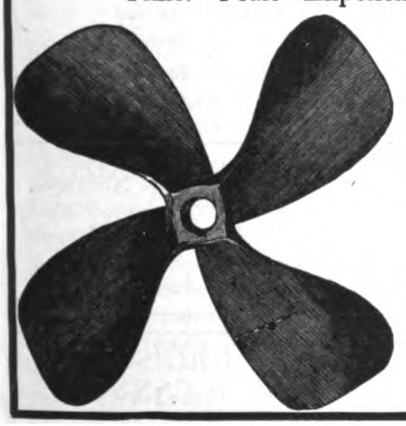

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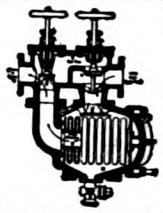

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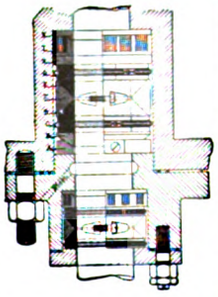

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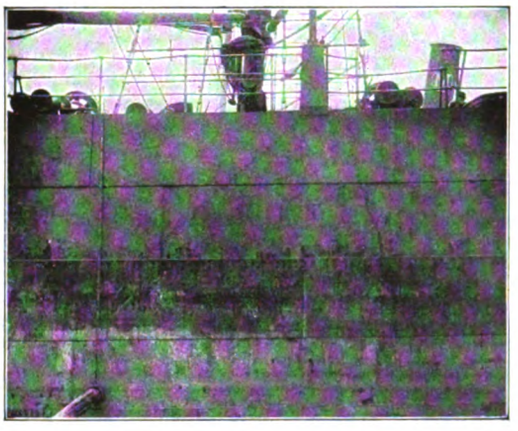

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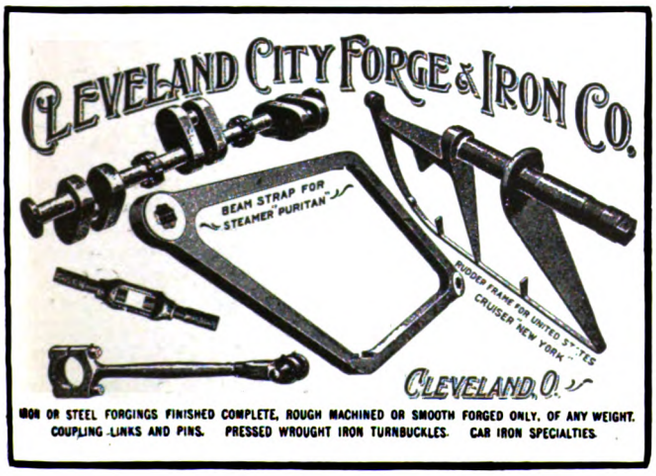
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